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Ontario - Legislative Assembly

SESSIONAL PAPERS

VOL. LIII.—PART II

SECOND SESSION

OF THE

FIFTEENTH LEGISLATURE

OF THE

183024.
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PROVINCE OF ONTARIO

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SESSION 1921

TORONTO:
Printed by CLARKSON W. JAMES, Printer to the King's Most Excellent Majesty
1922

Printed by
THE RYERSON PRESS

LIST OF SESSIONAL PAPERS

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Agricultural College, Report	30	*Printed.*
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Bee-Keepers Association, Report	37	*Printed.*
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Civil Service Commission, Report of	87	*Printed.*
Commission on University Finances, Report of	65	*Printed.*
Convictions under Temperance Act	84	*Not Printed.*
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Dairymen's Associations, Report	38	*Printed.*
Distribution of Statutes	60	*Not Printed.*
Dismissal, Lewis R. Luke	75	*Not Printed.*
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Friendly Societies, Report	11	*Printed.*
Fruit Growers' Association, Report	44	*Printed.*
Game and Fisheries, Report	14	*Printed.*
Goals, Prisons and Reformatories, Report	26	*Printed.*
Government Buildings outside, Return *re*	91	*Not Printed.*
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Lands, Forests and Mines, Report	3	*Printed.*
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No. 1 — Public Accounts of the Province for the year ending 31st October, 1920. Presented to the Legislature, 11th February, 1921. *Printed.*

No. 2 — Estimates—Supplementary for the service of the Province for the year ending 31st October, 1921. Presented to the Legislature, 15th February, 1921. *Printed.* Further supplementary estimates presented to the Legislature 15th April, 1921. *Printed.* Estimates for the year ending October 31st, 1922. Presented to the Legislature, 21st April, 1921. *Printed.*

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No. 3 — Report of the Minister of Lands and Forests for the year 1920. Presented to the Legislature, 29th April, 1921. *Printed.*

No. 4 — Report of the Department of Mines for the year 1920. Presented to the Legislature, 21st March, 1921. *Printed.*

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No. 5 — Report of the Inspector of Division Courts for the year 1920. Presented to the Legislature, 7th February, 1921. *Printed.*

No. 6 — Report of the Inspector of Legal Offices for the year 1920. Presented to the Legislature, 21st March, 1921. *Printed.*

No. 7 — Report of the Inspector of Registry Offices for the year 1920. Presented to the Legislature, 21st March, 1921. *Printed.*

No. 8 — Report of the Provincial Municipal Auditor for the year 1920. Presented to the Legislature, 15th February, 1921. *Printed.*

No. 9 — Report of the Commissioners for the Queen Victoria Niagara Falls Park for the year 1920. Presented to the Legislature, 29th April, 1921. *Printed.*

No. 10 — Report of Superintendent of Insurance for the year 1920. Presented to the Legislature, 15th February, 1921. *Printed.*

No. 11 Report of the Registrar of Friendly Societies for the year 1920. Presented to the Legislature, 15th February, 1921. *Printed.*

No. 12 Loan and Trust Corporations' statement being abstracts from financial statements made by building societies, loan companies, loaning land companies and trust companies for the year ended Decem- 31st, 1919. Presented to the Legislature, 1st February, 1921. *Printed.*

Report of the Registrar of Loan Corporations for the year 1920. Presented to the Legislature, 15th February, 1921. *Printed.*

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No. 13 Report of the Minister of Public Works for the year 1920. Presented to the Legislature, 15th February, 1921. *Printed.*

No. 14 Report of the Game and Fisheries Department for the year 1920. Presented to the Legislature, 7th March, 1921. *Printed.*

No. 15 Report of the Department of Public Highways for the year 1920. Presented to the Legislature, 28th April, 1921. *Printed.*

No. 16 Report of the Department of Labour for the year 1920. Presented to the Legislature, 29th April, 1921. *Printed.*

No. 17 Report of the Minister of Education for the year 1920. Presented to the Legislature, 13th April, 1921. *Printed.*

No. 18 Report of the Board of Governors of the University of Toronto for the year ending 30th June, 1920. Presented to the Legislature, 2nd February, 1921. *Printed.*

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No. 19 Report of the Secretary and Registrar of the Province for the year 1920. Presented to the Legislature, 28th April, 1921. *Printed.*

No. 20 Report of the Registrar-General relating to the Registration of Births, Marriages and Deaths for the year ending 1920. Presented to the Legislature, 1st March, 1921. *Printed.*

No. 21 Report of the Provincial Board of Health for the year 1920. Presented to the Legislature, 11th February, 1921. *Printed.*

No. 22 Report of the Inspector of Prisons and Public Charities upon the Ontario Hospitals for the Insane for the year 1920. Presented to the Legislature, 13th April, 1921. *Printed.*

No. 23 No Report.

No. 24 No Report.

No. 25 Report upon the hospitals and charitable institutions for the year 1920. Presented to the Legislature, 29th April, 1921. *Printed.*

No. 26 Report upon the prisons and reformatories for the year 1920. Presented to the Legislature, 13th April, 1921. *Printed.*

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No. 27 Report upon the neglected and dependent children for the year 1920. Presented to the Legislature, 29th April, 1921. *Not Printed.*

No. 28 Report upon the operation of the Ontario Temperance Act for the year 1920. Presented to the Legislature, 14th February, 1921. *Printed. Part 6, 1920, Sess. Vol.*

No. 29 Report of the Minister of Agriculture for the year 1920. Presented to the Legislature, 22nd April, 1921. *Printed.*

No. 30 Report of the Ontario Agricultural College and Experimental Farm. for the year 1920. Presented to the Legislature, 22nd April, 1921. *Printed.*

No. 31 No Report.

No. 32 Report of the Agricultural and Experimental Union for the year 1920. Presented to the Legislature, 27th April, 1921. *Printed.*

No. 33 Report of the Stallion Enrolment Board for the year 1920. Presented to the Legislature, 1st February, 1921. *Printed.*

No. 34 Report of the Vegetable Growers' Association for the year 1920. Presented to the Legislature, 27th April, 1921. *Printed.*

No. 35 No Report.

No. 36 Report of the Entomological Society for the year 1920. Presented to the Legislature, 22nd April, 1921. *Printed.*

No. 37 Report of the Beekeepers' Association for the year 1920. Presented to the Legislature, 22nd April, 1921. *Printed.*

No. 38 Report of the Dairymen's Associations for the year 1920. Presented to the Legislature, 22nd April, 1921. *Printed.*

No. 39 Report of the Live Stock Branch for the year 1920. Presented to the Legislature, 22nd April, 1921. *Printed.*

No. 40 Report *re* Housing of the Bureau of Municipal Affairs for the year 1920. Presented to the Legislature, 29th April, 1921. *Printed.*

No. 41 Report of the Women's Institutes for the year 1920. Presented to the Legislature, 22nd April, 1921. *Printed.*

No. 42 Report of the Agricultural Societies and the Convention of the Ontario Associations and Exhibitions for the year 1920. Presented to the Legislature, 16th February, 1921. *Printed.*

No. 43 Report of the Horticultural Societies for the year 1920. Presented to the Legislature, 27th April, 1921. *Printed.*

No. 44 Report of Fruit Growers' Association for the year 1920. Presented to the Legislature, 22nd April, 1921. *Printed.*

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No. 45 No Report.

No. 46 Report of the Statistics Branch of the Department of Agriculture for the year 1920. Presented to the Legislature, 22nd April, 1921. *Printed.*

No. 47 Report of Bureau of Municipal Affairs for the year 1920. Presented to the Legislature, 11th February, 1921. *Printed.*

No. 48 Report of the Temiskaming and Northern Ontario Railway for the year 1920. Presented to the Legislature, 10th March, 1921. *Printed.*

No. 49 Report of the Hydro-Electric Power Commission for the year 1920. Presented to the Legislature, 4th April, 1921.

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No. 50 Report of The Ontario Railway and Municipal Board for the year 1920. Presented to the Legislature, 21st March, 1921. *Printed.*

No. 51 A Return from the Records of the By-Elections to the Legislative Assembly held on the 19th day of July and the 8th day of November, 1920, shewing:—

(1) The number of Votes Polled for each Candidate in each Electoral District in which there was a contest; (2) The majority whereby each successful Candidate was returned; (3) The total number of Votes Polled; (4) The number of Votes remaining unpolled; (5) The number of names on the Polling Lists; (6) The number of Ballot Papers sent out to each Polling Place; (7) The Used Ballot Papers; (8) The Unused Ballot Papers; (9) The Rejected Ballot Papers; (10) The Cancelled Ballot Papers; (11) The Declined Ballot Papers; (12) The Ballot Papers taken from Polling Places; (13) A General Summary of Votes cast in each Electoral District. Presented to the Legislature, 25th January, 1921. *Printed.*

No. 52 Report of the Bureau of Archives for the Province of Ontario, 1920. Presented to the Legislature, 15th April, 1921. *Printed.*

—Supplement to Report of the Bureau of Archives, 1920. Presented to the Legislature, 27th April, 1921. *Printed.*

No. 53 The Report of the Librarian on the state of the Library. Presented to the Legislature, 26th January, 1921. *Not Printed.*

No. 54 Auditor's Report for the year 1919-20. Presented to the Legislature, 8th March, 1921. *Printed.*

No. 55 Report of the Workmen's Compensation Board for 1920. Presented to the Legislature, 28th April, 1921. *Printed.*

No. 56 Report on the Administration of Criminal Justice and Treatment of Prisoners in New York, Chicago, Detroit and Toronto, by His Honour Judge Coatsworth, Senior Judge of the County of York, Province of Ontario. Presented to the Legislature, 5th April, 1921. *Printed.*

No. 57 Report of the Ontario Board of Parole for the year ending 31st October, 1920. Presented to the Legislature, 21st February, 1921. *Printed.*

No. 58 Report of the Committee on Rural Credits. Presented to the Legislature, 11th February, 1921. *Printed.*

No. 59 Report of the Select Committee of the Legislative Assembly, as to a more equitable system of distribution of Hydro-Electric power and a more uniform price. Presented to the Legislature, 26th January, 1921. *Printed.*

No. 60 Statement of the distribution of the Revised and Sessional Statutes for the year 1920. Presented to the Legislature, 1st February, 1921. *Not Printed.*

No. 61 Regulations and Orders-in-Council passed since the last Session of the Legislature under the authority of the Department of Education Act, or of the Public Schools, Separate Schools or High Schools. Presented to the Legislature, 1st February, 2nd February, 14th February, 7th March, 21st March, 13th April, 1921. *Not Printed.*

No. 62 Interim Report *re* Issuers of Marriage Licenses, Public Service Commission. Presented to the Legislature, 11th February, 1921. *Printed.*

No. 63 Interim Report of the Public Service Commission *re* Police Magistrates. Presented to the Legislature, 11th February, 1921. *Printed.*

No. 64 The Minister of Lands and Forests presented to the House, a Return to an Order of the House showing 1. How many Timber Limits have been offered for sale since 1st December, 1919, and where situated. 2. Were they all sold by tender. 3. The date of sale, area, and price paid. 4. Were any withdrawn after being advertised, and if so, why. 5. How many tenders were received in each case. 6. The name of the successful tenderer. 7. The amount of bond given in each case by the successful tenderer. Presented to the Legislature, 16th February, 1921. Mr. *Tolmie*. *Not Printed.*

No. 65 Report of the Commission to enquire into and report upon a basis for determining the financial obligations of the Province toward the University of Toronto, and the financial aid which the Province may give to Queen's University of Kingston and the Western University of London, etc., etc. Presented to the Legislature, 21st February, 1921. *Printed.*

No. 66 Return to an Order of the House of the 14th day of February for a Return showing dates when tenders called for, the tenders received and the names of tenderers for the production of (*a*) Ontario Public School Readers, each respectively; (*b*) Ontario Public School Histories, each respectively; (c) Ontario High School History; (*d*) Ontario Composition and Grammar. Presented to the Legislature, 21st February, 1921. Mr. *Sinclair*. *Not Printed.*

No. 67 Interim Reports (First, Second and Third) of the Commission to investigate and report upon the accuracy or otherwise of all returns made pursuant to The Crown Timber Act, sec. 14, by any holder of a Timber License, etc., etc., etc. Presented to the Legislature, 23rd February, 1921. *Printed.*

No. 68 Return to an Order of the House of the 23rd February, 1921, for a Return of copies of all correspondence between the Minister of Lands and Forests, the Prime Minister, or any Minister of the Government and any official, representative or solicitor on behalf of the Spruce Falls Pulp & Paper Co., together with all estimates, reports, conditions of sale, maps, documents and papers of every kind and nature, relating to (1) The sale of the Kapuskasing Soldiers' and Sailors' Settlement Colony; (2) The additional area acquired by the Company to add to the concession known as the Kapuskasing Pulp Concession; (3) Relating to the establishment of the Government Town Site at Kapuskasing. Presented to the Legislature, 24th February, 1921. Mr. *Magladery*. *Not Printed.*

No. 69 Annual Report of the Soldiers' Aid Commission of Ontario for year ending 31st October, 1919. Presented to the Legislature, 1st March, 1921. *Not Printed.*

No. 69 Report of Soldiers' Aid Commission for the year 1920. Presented to the Legislature, 21st March, 1921.

No. 70 Return to an Order of the House of 23rd February, 1921, that there be laid before the House, a Return showing the number of Issuers of Marriage Licences in the Province of Ontario, with their names and addresses and the date of their appointment. Presented to the Legislature, 1st March, 1921. Mr. *Ross*, Kingston. *Not Printed.*

No. 71 Return to an Order of the House of 9th February, 1921, that there be laid before the House a Return of copies of all correspondence, papers and documents since 13th November, 1919, relating to conduct or duties of Magistrates, Justices of the Peace and other officers with reference to enforcement of The Ontario Temperance Act. Presented to the Legislature, 1st March, 1921. Mr. *Hill*. *Not Printed.*

No. 72 Return to an Order of the House of 23rd February, 1921, that there be laid before the House a Return of copies of the Report of the Superintendent of Provincial Police to the Attorney-General for the years 1918, 1919 and 1920. Presented to the Legislature, 1st March, 1921. Mr. *Godfrey*. *Not Printed.*

No. 73 Return to an Order of the House of 23rd February, 1921, for a Return showing copy of Agreement between Provincial Board of Health and Federal Health Department relating to prevention of Venereal Diseases. 2. What amount has already been received by the Province to date. Presented to the Legislature, 4th March, 1921. Mr. *Price*. *Not Printed.*

No. 74 Return to an Order of the House of 4th February, 1921, for a Return of copies of all correspondence passing between the Government of Ontario or any member, officer or official thereof, or of any department thereof and any member of the House or other person leading up to it, and dealing with the suspension and resignation of Messrs. Smith and Hanna from the Provincial Police. Presented to the Legislature, 4th March, 1921. Mr. *Tolmie*. *Not Printed.*

No. 75 Return to an Order of the House of the 4th February, 1921, for a Return of copies of all correspondence with and by the Government or any department thereof leading up to and relating to the dismissal of Mr. Lewis R. Luke as License Inspector for Ontario County. Presented to the Legislature, 4th March, 1921. Mr. *Sinclair*. *Not Printed.*

No. 76 Statement and Report of the Ontario Athletic Commission and of Auditor for the year 1920. Presented to the Legislature, 4th March, 1921. *Not Printed.*

No. 77 Report of the Commission upon the rates of wages paid to men employed by The Hydro-Electric Power Commission in the construction of the Queenston-Chippewa Development. Presented to the Legislature, 4th March, 1921. *Printed.*

No. 78 Return to an Order of the House of 28th February, 1921, that there be laid before the House a Return of copies of all letters, reports and communications of every kind received by the Minister of Mines or any member of the Government with respect to the proposed increase in mining taxes. Presented to the Legislature, 9th March, 1921. Mr. *Ferguson. Not Printed.*

No. 79 Return to an Order of the House of 23rd February, 1921, for a Return of copies of all correspondence between the Government or any member or any Minister or official and the Canada Copper Company (International Nickel Company) and George E. Buchanan relating to leases or grants of nickel-bearing or other mineral lands in the Township of Creighton, District of Sudbury, since 13th November, 1919. Presented to the Legislature, 10th March, 1921. Mr. *Dewart. Not Printed.*

No. 80 Interim report respecting Coroners of the Commission to inquire, consider and report upon the best mode of selecting, appointing and remunerating Sheriffs, etc., etc. Presented to the Legislature, 18th March, 1921. *Printed.*

No. 81 Report of the Committee on Proportional Representation. Presented to the Legislature, 5th April, 1921. *Printed.*

No. 82 Return to an Order of 16th February, 1921, that there be laid before the House a Return showing what are the amounts paid by each Company respectively which make up the total credited to The Mining Tax Act in the Public Accounts for 1920 at page a31 under the heading: (*a*) Acreage tax, $71,223.26; (*b*) Profits tax, $713,291.46. Presented to the Legislature, 21st March, 1921. Mr. *McAlpine. Not Printed.*

No. 83 Return to an Order of the House, of 9th February, 1921, that there be laid before the House a Return showing:—1. What was the total quantity of fish caught in Lake Nipissing and Lake Nipigon, respectively, and marketed in the following years—1917, 1918, 1919 and 1920. 2. What were the varieties of fish caught and marketed in Lake Nipissing and Lake Nipigon respectively, and

the quantity of each. 3. What was the price paid to fishermen for each variety; what was the price at which the Government sold each variety; to whom were such sales made. 4. To whom were licenses issued to take fish from Lake Nipissing and Lake Nipigon respectively, in the years 1917, 1918, 1919 and 1920. 5. Is it the intention of the Government to continue this Fishery Department as a commercial enterprise. 6. What were the gross receipts from fish sales in Lake Nipissing and Lake Nipigon in the years 1917, 1918, 1919 and 1920, and what were the net profits of the Government in each of said years. Presented to the Legislature, 1st April, 1921. Mr. *Mageau*. *Not Printed.*

No. 84 Return to an Order of 23rd February, 1921, that there be laid before the House a Return showing the number of convictions made under The Ontario Temperance Act for breaches of the said Act for year 1919-20: 1. At the instance of officers of the Board of License Commissioners. 2. At the instance of officers of the Ontario Provincial Police. 3. At the instance of Municipal Police officers. 4. The number of cases in which fines or sentences have been remitted, reduced, or commuted: (1) Upon the recommendation of the Board of License Commissioners; (2) Without the recommendation of the Board of License Commissioners. Presented to the Legislature, 13th April, 1921. Mr. *Godfrey*. *Not Printed.*

No. 85 Copy of Report of R. D. Johnson *et al* on the Queenston-Chippawa Power Development, with statement of professional record of H. S. Kerbaugh and Francis Lee Stuart, with letters. Presented to the Legislature, 13th April, 1921. *Printed.*

No. 86 Report of R. S. Lea, Consulting Engineer of Progress on Queenston-Chippawa Power Development, 31st January to 9th April, 1921. Presented to the Legislature, 13th April, 1921. *Printed.*

No. 87 Report of the Civil Service Commissioner for Ontario, 1920. Presented to the Legislature, 15th April, 1921. *Printed.*

No. 88 First Annual Report of The Mothers' Allowances Commission for the year 1920. Presented to the Legislature, 20th April, 1921. *Printed.*

No. 89 Final Report of Hugh L. Cooper & Co. *re* Queenston-Chippawa Development of the Hydro-Electric Power Commission of Ontario. Presented to the Legislature, 21st April, 1921. *Printed.*

No. 90 Return to an Order of the House of the 25th February, 1921, that there be laid before this House a Return showing:—1. How many miles are included in the Ottawa-Prescott Highway. 2. How

many miles of this Highway were completely graded at the end of the year 1920. 3. How much grading still remains to be done. 4. What was the average cost *per* mile of the grading completed. 5. What amount was spent during the year 1920 on equipment for the Ottawa-Prescott Highway. 6. How many men were employed in each of the months of 1920. 7. Has the Government purchased any gravel pits or stone quarries along or in the vicinity of the right-of-way of the Ottawa-Prescott Highway, and if so (*a*) From whom; (*b*) What was paid for each; and (*c*) What was the area of each. 8. Has the Government rented any gravel pits or stone quarries along or in the vicinity of the right-of-way of the Ottawa-Prescott Highway, and if so (*a*) From whom; (*b*) What was paid for each; and (*c*) What was the area of each. 9. Did the Government purchase any gravel or stone for the right-of-way of the Ottawa-Prescott Highway, and if so (*a*) From whom; (*b*) What was paid per cubic yard; and (*c*) What was the total amount paid each man. 10. How many culverts were built during the year 1920. 11. How many still remain to be completed. 12. How many culverts were built (*a*) By day labour; (*b*) By contract. 13. If any were built by the latter (*a*) Who were the contractors; (*b*) What were the unit prices paid; (*c*) What lump sums were paid to each contractor. 14. What was the cost *per* cubic yard of the said culverts in place built by day labour. 15. What was the cost *per* cubic yard of the said culverts in place built by contract. 16. What was the total amount spent on the Ottawa-Prescott Highway to 31st December, 1920. 17. Have the plans of the said Highway been filed in the Federal Department of Railways pursuant to the Canada Highways Act, and if so, when. 18. Has a subsidy agreement been signed with the Dominion Government pursuant to the Canada Highways Act. 19. If so, what is the date of the agreement. 20. Has the Government received any payments on account of Dominion Government subsidy, and if so, the dates and amounts of the payments. 21. What wages were paid during 1920, on the Ottawa-Prescott Highway (*a*) For unskilled labour; (*b*) For teams with driver. 22. How many hours a day did the men employed on the road during 1920 work. 23. Who was the engineer in charge of the road during 1920, and what was his salary. 24. Has the Government settled with all the parties from whom the right-of-way was acquired. 25. If the answer to 24 is in the negative, what parties still remain to be settled with. Presented to the Legislature, 28th April, 1921. Mr. *Hill*. *Not Printed.*

No. 91 Return to an Order of 4th March, 1921, that there be laid before this House a Return showing:—1. What places in the City of Toronto are employed for Government use outside the Legislative Building. 2. For what Department, Commission or Board are they being used. 3. What are the terms of rental or lease. 4. How much has been expended on improvements on each place

to date. 5. On what dates was possession taken under the different leases. 6. How many employees are at work in each of the respective buildings so leased. Presented to the Legislature, 29th April, 1921. Mr. *Ross*, Kingston. *Not Printed.*

No. 92 Return to an Order of 21st February, 1921, that there be laid before this House a Return of copies of all papers and correspondence between the Government or any member thereof or any official on behalf of the Government and any other Corporation or person relating to: (*a*) Loan "R.R." sold to syndicate composed of the Dominion Securities and others: (*b*) Loan for $16,000,000 at 6 *per cent.*, repayable in fifteen years for which the price of 92.34 was realized; (*c*) The loan "S.S." sold to the syndicate composed of Aemilius Jarvis and others; (*d*) The loan for $10,000,000 at 6 *per cent.*, repayable in twenty years for which the price of 96.787 was realized. Presented to the Legislature, 29th April, 1921. Mr. *Hay*. *Not Printed.*

No. 93 Copies of Orders-in-Council designating, pursuant to section 14 of The Hospitals and Charitable Institutions Act, Hospitals, Refuges, Orphanages and Infants' Homes, to which aid be granted. Presented to the Legislature, 29th April, 1921. *Not Printed.*

No. 94 Report of the Commission to inquire into and report upon the truth or falsity of the charges made against David Hastings, Police Magistrate, Dunnville. Presented to the Legislature, 29th April, 1921. *Not Printed.*

REPORT

OF THE

Minister of Lands and Forests

OF THE

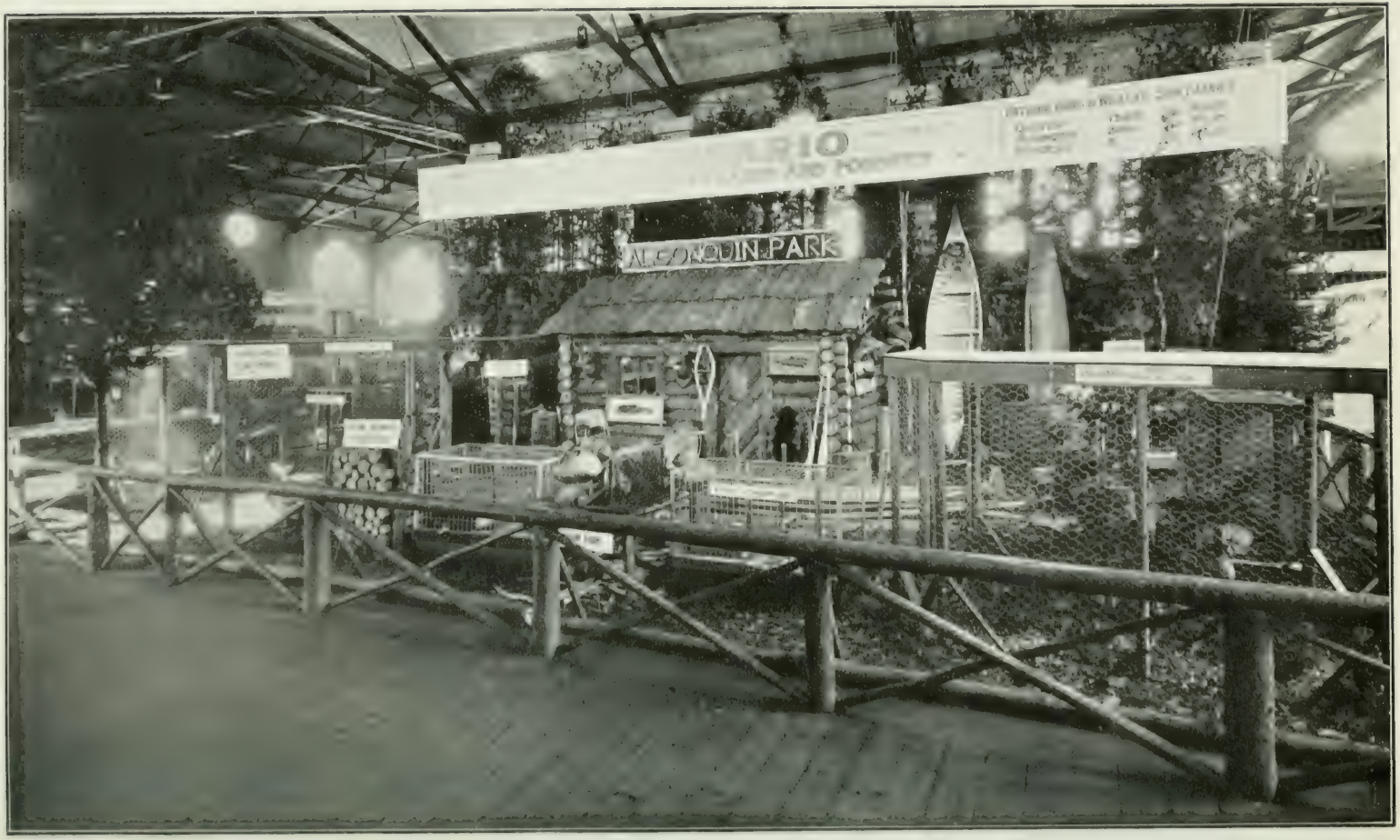
PROVINCE OF ONTARIO

For the Year Ending 31st October

1921

PRINTED BY ORDER OF
THE LEGISLATIVE ASSEMBLY OF ONTARIO

TORONTO:
Published by CLARKSON W. JAMES, Printer to the King's Most Excellent Majesty
1922



Provincial Parks' Exhibit, Toronto Exhibition, 1921

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Report of the Minister of Lands and Forests of the Province of Ontario

For the Year Ending 31st October, 1921.

To His Honour the Lieutenant-Governor of the Province of Ontario.

May it Please Your Honour:

I have the honour, in conformity with the provisions of the Public Lands Act respecting the proceedings and transactions of the Department of Lands and Forests, to submit for the information of Your Honour and the Legislative Assembly, a report for the fiscal year ending the 31st day of October, 1921, covering the management and operations of the Department in its various branches.

The fiscal year ending 31st October, 1921, may well be regarded as the most successful in the history of the Province so far as the Department of Lands and Forests is concerned, from the viewpoint of movements in land transactions (when the war conditions and the reconstructive period subsequent thereto are considered) and in timber operations and of revenue results.

Lands.

While the year 1919-20, the second year after the war, indicated a tendency towards a return to normal in the acquiring of lands for settlement, the past year shows a considerable increase over that of 1920, both as respects the numbers taking up Free Grant lands and those purchasing farming locations under settlement regulations. There has been an appreciable influx of settlers to the great Clay Belt of Northern Ontario, particularly that section traversed by the National Transcontinental Railway, and they are of such a class that will in all probability succeed in pioneer work. The prospects of a development at Kapuskasing, following the Spruce Falls Company acquiring the timber limit there, gave an added impetus to the demand for settlers' locations, and again it is more or less axiomatic that during any stage of labor depression, with its resultant lack of employment, an eagerness is manifested amongst a certain class to secure Crown land under the reasonable terms held out.

The revenue derived from the sale and lease of lands and rentals of water powers reached over $215,000.00, the largest in the experience of the Department within the last 20 years, except for the year 1912 (when two townships, Haggart and Kendry, were sold holus bolus for approximately $100,000.00 to a Colonization Company, the cancellation of whose agreement the Crown is now contemplating), and with the exception of a few years, the largest since Confederation.

Systematic inspections as time and staff afforded were regularly made towards checking up delinquent settlers, and as a result of such inspections

a goodly number of claims were cancelled. Over 800 settlers who proved up acquired their patents.

Particulars in respect of land transactions are hereafter detailed.

Clergy Lands.

There were sold and leased of the Clergy lands during the year 12½ acres for $31.25, and the collections on account of these and former sales of such lands amounted to $612.90. (See Appendix No. 3, page 23).

Common School Lands.

Of these lands, the collections during the year from sales and leases amounted to $3,447.80, but there were no sales. (See Appendix No. 3, page 23.)

Grammar School Lands.

The area of these lands sold during the year was 57½ acres for $28.75. The collections on account of these and former sales amounted to $529.84. (See Appendix No. 3, page 23.)

University Lands.

The number of acres of these lands sold and leased during the year were 836.38 for $418.25. The amount collected on account of these and former sales was $1,917.67. (See Appendix No. 3, page 23.)

Crown Lands.

The total area of these lands sold for agricultural and townsite purposes during the year was 139,026.86 acres for $143,059.02. The collections on account of these as well as former sales amounted to $135,862.27. This shows a marked increase in the sale of lands as compared with former years. For instance, in 1920 the number of acres sold amounted to 72,500. The collections from sales show an increase of over 50 per cent.

The total area leased was 20,524.85 acres for $2,286.50. The collections from these sales and leases amounted to $56,588.93. From this it will be seen that the area leased is double that of the previous year.

There were 21 acres leased in the Timagami Reserve and collections of previous sales amounted to $900.50. (See Appendix No. 3, page 23.)

Settlers on Purchased Lands.

As shown in the preceding paragraphs, there has been an increased demand for this class of land and from the inquiries received indications are that this influx will continue. Land in the agencies of Englehart, Matheson, Cochrane and Hearst is being largely acquired by actual and bona fide tillers of the soil.

The actual number of purchasers was 736, while permission was granted to 314 to assign their interests covering an area of 44,037 acres, which were taken up by other settlers. The purchase price in full was paid in all these cases.

There were 398 sales cancelled, as the purchasers had failed to comply with the regulations as regards actual settlement, and these lands were again placed in the market to be acquired by actual settlers.

During the year the settlement duties were completed by 307 settlers and they were granted patents for their land.

A large number of returned soldiers from the war were granted areas of 160 acres free during the year, the total number being 257. (For details see Appendix No. 13, page 40.)

Free Grants.

A continued desire of settlers to take land for Free Grant homesteading has resulted in another increase over former years, 868 parties being located for free grant lands. More productive farming of somewhat smaller areas, and more care in the selection of land suitable for that purpose, is shown by the fact that the average individual farm has decreased from 166 acres to 136 acres, the total area located being 118,637 acres.

The number of settlers who completed their requirements of clearing and actual residence has also increased to the number of 500, while 132 locatees availed themselves of the statutory privilege to purchase additional land and 10,202 acres were purchased in that way. This is an increase of over 4,000 acres from last year. (See Appendix No. 13, page 40.)

Ranching.

There is a growing demand for land for ranching and pasture purposes as a result of the policy adopted by the Department, of leasing these lands at five cents per acre per annum, easy conditions as to stocking. Farmers who have their farms practically all under grain crops are acquiring additional areas and enlarging their activities to that of sheep and cattle raising. Rough areas of land more adapted for ranching or pasture have been largely taken up for this purpose, and during the year eight licenses of occupation have been issued, covering an area of 10,435 acres.

Several inquiries have been received for marsh or low lying lands for the purpose of raising muskrats and other fur-bearing animals, which promises to be an industry which may make valuable, lands that at the present time have practically no market value.

Military Grants.

Under the Act 1, Edward VII, Cap. 6, and amendments thereto, there have been issued 13,998 certificates and although the time for receiving applications for these grants expired on the 30th September, 1908, there are still letters being received from men or their next of kin, who were entitled to this grant, who claim that they have only now become aware of the fact. These applications, therefore, could not now be accepted and no forms of applications have been sent out.

During the past year there have been located 27 of these certificates covering 4,360 acres in the townships open for veterans, making in all a total of 8,391 certificates thus located.

In two cases the certificates have been surrendered and applied in payment of lands purchased from the Crown, covering in all 160 acres, making a total of 800 that have thus been applied.

There were two certificates surrendered to the Crown for the $50.00 commutation money, making a total of 3,266 certificates surrendered in this manner.

During the year there have been issued 48 patents for lands located by veterans, and in all, 7,488 have thus been disposed of.

The total number of certificates that have therefore been disposed of is 12,505, leaving 1,493 that are still outstanding.

During the year 10 veteran locations, covering 1,590 acres, were cancelled for the non-performance of the settlement duties to which they became subject on account of being assigned before patent issued. (See Appendix No. 11, page 38.)

Collections.

The total revenue, the largest ever received, from all sources was $4,035,747.94, or over one million dollars more than the preceding year. The sale of agricultural lands and townsites, with Crown leases, including Provincial Parks, provided $217,151.76; Fees $2,020.63; Refund items $53,135.07. From Woods and Forests the revenue was $3,763,440.48, classified as follows: Bonus $1,555,770.69; Timber Dues $1,921,356.95; Ground Rent $99,245.12; Transfer Fees $5,810.00; Fire Protection $181,257.72. (See Appendix No. 4, page 24.)

Disbursements.

The total expenditure, less Civil Government, of the Department for all services (exclusive of those rendered under the Northern and North-Western Ontario Development Acts, for which see Appendices Nos. 45, 46 and 47), was $2,029,453.27. Some of the more important items were: Crown Land Agents' Salaries and Disbursements, $20,717.00; Homestead Inspectors, $25,556.58; Crown Timber Agents, $35,860.70; Fire Ranging, $547,474.47; Forest Ranging and Measurement of Timber, $339,428.11; Reforestation, $83,372.63; Algonquin Provincial Park, $40,705.81; Quetico Provincial Park, $13,606.37; Rondeau Provincial Park, $15,295.90; Surveys, $145,169.99; Colonization Roads, $506,180.80; Commissions re Sundry Investigations, $63,781.05; Special Warrants, $58,178.77; Special Survey, Ontario and Manitoba Boundary, $12,500.00; Clearing Fire Hazards and Kapuskasing Lands, $14,786.81. (Additional details are found in Appendix No. 6.)

Woods and Forests.

Timber Returns.—Revenue accruels from timber transactions amounted to $3,698,267.73, the largest in the history of the Province, as against $3,120,808.41 for last year, and indicate the extent to which operations were conducted during the fall of 1920 and the winter of 1921. The Department succeeded in collecting some $65,000 more than the ordinary accrued revenue, a follow-up system having been introduced along with the practice of continuing to insist upon payment where such would not tend to cripple an industry and the Crown was amply protected by cash deposits and guarantee bonds.

An important factor in the increased revenue was the raise in the timber dues made by the present government in April, 1920. Pine dues were raised to $2.50 per M. feet B.M.; Spruce Pulpwood to 80 cents a cord, and other Pulpwoods to 40 cents a cord, while increases in respect of other classes of timber and wood were made all along the line.

The Timber Revenue collected totalled $3,763,440.48, an increase over 1920 of $1,106,809.97.

During the past season 336,957,487 feet B.M. of sawlog, boom and square pine timber was cut, or an increase of 24 million feet over the previous year's cutting. Saw log timber, other than pine, was cut to the extent of 66,811,220 feet B.M., as against 52,729,965 feet B.M. for the season of 1919-20, or an

increase of over 14,000,000 feet B.M. Boom and dimension timber, other than pine, cut totalled 3,581,015 feet B.M. Square timber amounted to 83,066 cubic feet, while piling accounted for 48,187 lineal feet and 438,412 feet B.M.

The cut of pulpwood on Crown lands reached the unprecedented figure of 928,185 cords, or over three times the quantity taken out the previous season.

The same activity in tie production did not continue throughout the year as in the two years immediately preceding, as only 4,001,471 ties were returned; the heavy stocks the railways had carried over from their former contracts and the diminution in railway construction lessened the demand. (See Appendix No. 7, page 34.)

Lumber Industry.—The general depression existing throughout the country has had a serious effect upon the lumber market, which has not a very bright outlook for the coming year. Although I understand from certain dealers the situation is somewhat improving, there is a pessimistic tone found particularly amongst the small operators, and this will materially affect their bush business this coming year. A number of the small operators with heavy unsold stocks on hand, hesitate to put organizations in the woods because of the uncertain prospects and but few of the large firms are undertaking to conduct operations to the peak of the past year. While labour during 1920-21 was considerably high and cost of production proportionately so, the outlook for next season points to lower wages and a consequent reduction in overhead expenses. Because of cheaper and more efficient labour, larger operators are prepared to take their chances on an improvement in an unstable market.

Pulpwood.—The upward trend of pulpwood induced by the constant and sustained market during the war, continued throughout 1919, and resulted in unprecedented operations in the bush, there being no less than 928,185 cords, as above stated, cut from Crown lands during the fiscal year ending the 31st October, 1921, or 621,489 cords in excess of that taken the previous year.

A decided lull in the pulpwood business, however, set in before the large stock could be marketed, and the industry has been most adversely affected; the outlook at present for an early return to conditions approaching those of a few years ago are not the brightest.

The general declining market for Ontario pulp in the United States has been accentuated by the European importations, particularly from Germany and Scandinavian countries, the rate of exchange working to the serious disadvantage of American producers in Ontario. The restrictions thus imposed upon our pulp and paper are for the time keenly felt. The Kapuskasing limit is not being worked this year owing to the market conditions, and while during the season of 1920 the English River Concession was sold, and Nipigon, Nagagami and Long Lake were disposed of during the past year, there is apparently no prospect of an immediate development. Efforts, I understand, are being made towards bringing about legislation in the United States for a correction in the tariff laws to stablilize exchange and any measure leading to this end would benefit the producers and proportionately enhance the demand. With a gradual consumption of the somewhat abnormal stocks of pulp and paper now held will come, it is hoped, a further call for the raw material and then there will be a resumption of the industry and trade.

Pulpwood agreements, covering important areas, to the number of four, were entered into, as follows:

English River, District of Kenora, 3,046 square miles. (See Appendices Nos. 49 and 50.)

Nagagami Pulp and Timber Limit, District of Algoma, 2,300 square miles. (See Appendix No. 52.)

Long Lake Limit, District of Thunder Bay, 3,400 square miles. (See Appendix No. 53.)

Nipigon Pulp and Pine Limit, District of Thunder Bay, 1,240 square miles. (See Appendix No. 51.)

It is considered desirable and advisable to furnish for public reference a regular list of timber berths sold each year, and while I intimated in last year's report such a list was being prepared for the present report, I have decided to collate such data under a separate publication as may be necessary to cover the timber sales and pulp concessions effected not only since the change of Government in 1919, but for a reasonable period prior to that. Dating from such separate publication, the timber sales should appear annually in the Minister's Report.

Lands under License.

The area under license at the close of the fiscal year 31st October, 1921, was 19,855½ square miles, on which a ground rent of $5.00 per square mile is charged. This was an increase of 4,960¼ square miles over the previous year.

Summary of Timber Revenue.

Bonus	$1,555,770.69
Timber Dues	1,921,356.95
Ground Rent	99,245.12
Transfer Fees	5,810.00
Fire Protection	181,257.72
	$3,763,440.48

Cullers' Examination.

Two examinations were held during the year, one at Callander and one at Kenora, on the 28th day of September, 1921.

Seven candidates successfully passed the examination and were duly granted certificates authorizing them to act as Cullers.

(For names of Cullers who passed at these examinations, see Appendix No. 10, page 38.)

(For complete list of Licensed Cullers, see Minister's Reports for 1917, 1918, 1919 and 1920.)

Timber Commission.

The Special Commission consisting of Justices W. R. Riddell and F. R. Latchford, appointed in March, 1920, to inquire into the management and disposition of the timber resources of the Province, has not yet submitted its main report, though it did hand down certain interim reports. The complete report, when made will no doubt, be duly printed. In the meantime references to its work and results are unnecessary.

Crown Surveys.

During the year surveys carried on in the northern part of the Province consisted of the running and posting of several base and meridian lines, township outlines, lake and river traverse, including the survey of islands therein.

The Inter-Provincial Boundary between the Provinces of Ontario and Manitoba north from the Winnipeg River, has also been defined on the ground for a distance of 70 miles.

Government Town Plot surveys have been made at Kapuskasing, in the District of Timiskaming, and at Hearst, in the District of Algoma, and Government Park Lots surveyed at Bala in the District of Muskoka.

Approval has been given to private town plot subdivisions on lands patented since 1910 pursuant to R.S.O. 1914, chapter 34, as follows:

Town Plot of Calvert, in the Township of Calvert, District of Timiskaming.
Town Plot of Capreol Addition, in the Township of Norman, District of Sudbury.
Kirkland Lake Extension, in the Township of Teck, District of Timiskaming.
Swastika Addition, in the Township of Teck, District of Timiskaming.
Moonbeam, in the Township of Fauquier, District of Timiskaming.

Municipal Surveys.

Pursuant to sections 15, 16 and 17 of the Surveys Act, petitions for resurveys of original road allowances have been received from the Corporations of the Municipalities of:

City of Toronto,
Township of Hinchinbrooke,
Township of Maidstone,
Township of Sandwich East,
Township of Anderson,

and the necessary instructions have been given for the required surveys.

The municipal surveys which were being performed under instructions of prior date and which were confirmed during the year were those on petition from:

(a) Township of Beverley.
(b) Township of Gloucester.

Detailed descriptions and reports of the several surveys made will be found in Appendices 19 to 40, inclusive.

Parks.

The Department, for the first time in its history, installed an exhibit at the Canadian National Exhibition, Toronto, of the Forests and Wild Life from its National Forest Reserves and wild life sanctuaries, Algonquin, Quetico and Rondeau Parks.

A picturesque log cabin representing the forest ranger's home, snugly set against a background of spruce, pine, balsam and birch trees, with wild animals and feathered creatures in the foreground proved attractive.

Inc'uded in the many and distinguished visitors who viewed the exhibit was the Governor-General, who expressed himself thus: "This is a revelation and an education to me. To see a section of our northland hastily bundled

together in quaint frontier disorder, with the aroma of the forest still clinging about it, brought down and planted on the doorstep of Toronto, affording the public an opportunity to catch a breath of the pine, the spruce and the balsam. It is wonderful."

Dr. Powell said: "Why do the teachers neglect this exhibit? Here the children can receive object lessons in one visit, which are a hundred times more impressive, more lasting and more interesting than can be derived from books in six months' study."

Part of the exhibit were live bears and beavers, a family of Canada red deer, fisher, porcupine, foxes and raccoons, together with silver and golden pheasants, Lady Amhersts, Reeves and English pheasants. There were trees of twenty inches in diameter cut down by the industrious beaver; traps used only in Algonquin Park for capturing wild animals alive without injury; great grey timber wolf skins; Indian guides making birch-bark canoes and a squaw lacing snow-shoes. Cones and pine needles were used to typify the floor of the forest.

The whole exhibit proved interesting and educative and should be reproduced annually along improved lines to impress visitors from all parts of the world and our own people with the wealth of our natural rresources.

(For the reports on the parks by the Superintendents, see Appendices 41, 42 and 43.)

Colonization Roads.

The sum of $506,180.80 was spent on this service, of which $420,467.53 was spent in organized municipalities, the balance being devoted to unorganized municipalities. The class of work covered the construction and repair of roads, and bridges, and the purchase of road machinery. The Branch carried on the work of inspecting and surveying new road sites and of mapping old roads down, the importance of which work has been minimized in the past. It is proposed to continue the surveying and mapping of roads that adequate records may be had of the roads built and reliable data as to the roads which the Branch contemplates constructing.

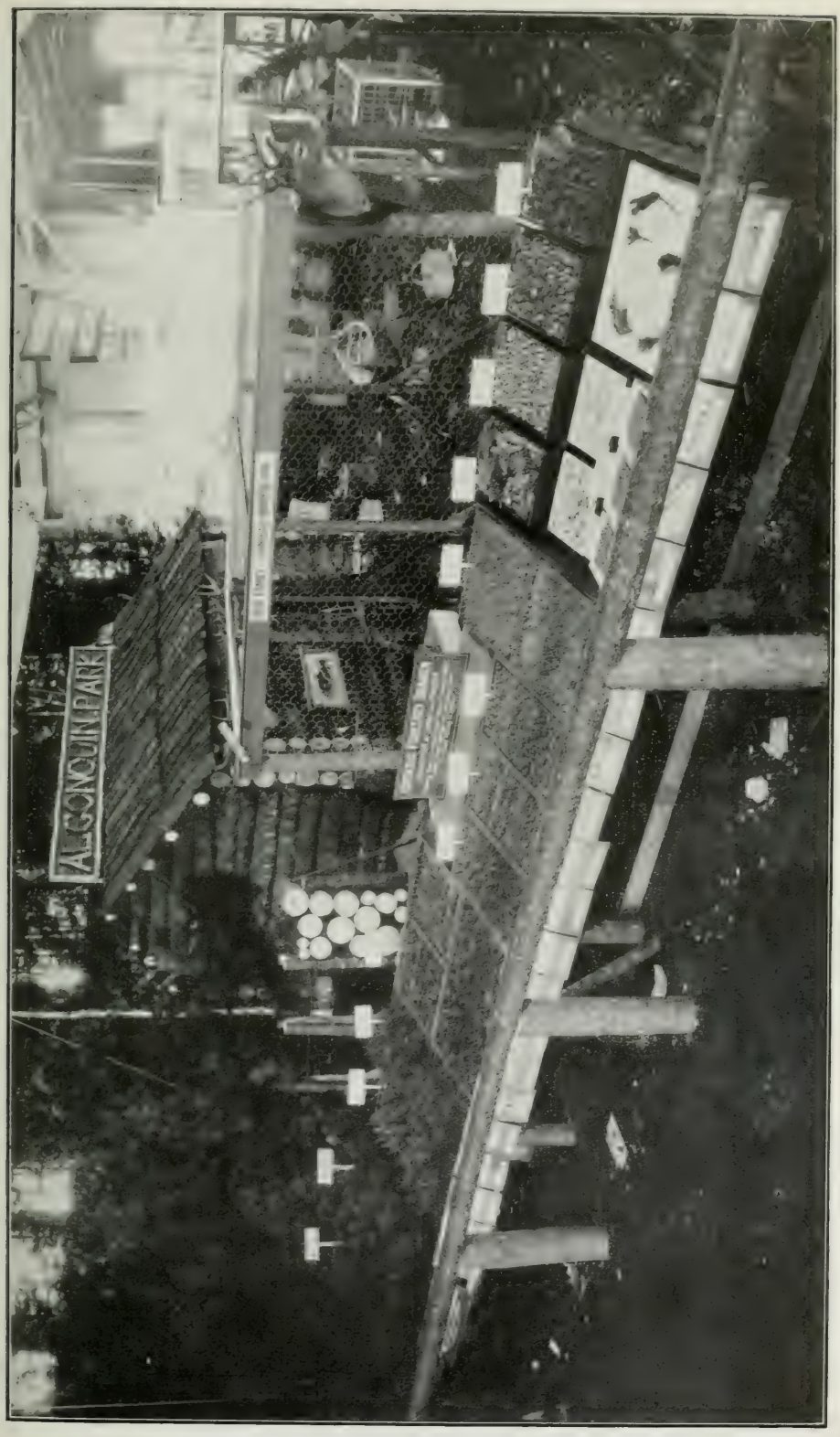
For details of the work carried on and expenditures made, see Appendix No. 44, page 129.)

Northern Development Branch.

The expenditures carried on by this Branch under statutory authority of the Northern and North-western Ontario Development Act totalled $1,612,522.37, of which over 85 per cent. was spent in the making of roads and bridges. The balance was used to carry on the advancement of settlement and colonization, under which assistance to settlers was granted in the way of purchasing hay, oats, seed grain and cattle. Creameries were assisted and advances or loans made to settlers through the Settlers' Loan Commissioner.

(For detailed information in connection with the work done see Appendices Nos. 45 and 46, pages 152—203 inclusive.)

(For full information in connection with the Settlers' Loan Accounts, see Appendix No. 47, page 204.)



Re-forestation Exhibit, Toronto Exhibition, 1921.

FORESTRY BRANCH.

Fire Protection.

This past season forest fire protection was made very difficult owing to the lack of snow during the winter and the extremely dry weather prevailing in most parts of the Province during the summer. The small amount of snow during the winter disappeared very early in the spring. In many districts very little rain fell until August, and in some districts late in September. It is interesting to note that fires of railway origin are rapidly decreasing. The following table shows the percentage of fires of railway origin:

In 1917	49.5 per cent.
In 1918	46.5 per cent.
In 1919	37.0 per cent.
In 1920	23.9 per cent.
In 1921	14.8 per cent.

It is felt that the improvement in connection with fires of railway origin is largely due to the increased protective methods applied along railway lines and largely to the increased efficiency of locomotive inspection work. During the past season 1,526 round-house inspections were made, showing a decrease in the number of defective locomotives over past years. In 1918 there were 32 per cent. of the locomotives defective; in 1921 only 8.3 per cent. were found defective.

As usual a large percentage of the area burned over by fires during the past season occurred on cut-over lands. As might be expected, these cut-over areas, with the resultant slash, are very difficult to protect.

During the past season 5,966 permits were issued for the burning of slash, which covered 23,678 acres.

The most important additions to equipment during the past season was the securing of additional portable fire fighting pumps. These pumps are supplied with 500 to 1,000 feet of hose and have more than saved their cost in saving wood products in connection with fire protection.

Forest Investigation.

During the past season the Forestry Branch has completed a survey of the southern portion of the fire district commonly known as the Huron-Ottawa region. From this survey working plan and maps are being prepared in connection with forest protection and reforestation on the old cut-over areas of this region.

Reforestation.

The outstanding feature of the work in reforestation during the past season has been enlargement of the Provincial Forest Station in Norfolk County. At this station large quantities of coniferous seeds were sown during the past spring, and a very fine stand of one year old seedlings has been obtained.

The nurseries at present have a total of some nine million plants, which should insure at least seven or eight million plants ready for final planting.

An enlarged water system has been installed with a 20,000 gallon tank, which, it is expected, will meet the requirements of the new nursery development.

The distribution of trees to private applicants was increased over the previous year. 291,769 plants were distributed for demonstration plantings by private owners.

In addition to experimental planting made at the forest station in Norfolk County, a new sub-station was opened in Prince Edward County, where some 150 acres were planted on the sand dune formations near West Lake.

The collection of tree seeds has been greatly enlarged and during the past season a fine quantity of native Norway or Red Pine was secured. The Red or Norway Pine is well suited for the planting of sandy waste lands of the Province, and we desire large quantities of nursery stock of this species.

Tree Disease.

The investigation of tree diseases was again carried on by the Forestry Branch in the Timagami Forest Reserve region. (Details of this work will be found in the Forestry Branch Report, Appendix No. 48.) It would appear that the insect and other organic enemies of our forest trees will soon prove as serious a menace as forest fires. It is hoped that some adequate solution of this problem may be found.

Officers Superannuated.

(1) J. H. Bradshaw, Clerk in Colonization Roads Branch, appointed June 10th, 1884, and superannuated January 1st, 1921.

(2) J. B. Cook, Clerk in the Woods and Forests Branch, appointed August 7th, 1894, and superannuated January 1st, 1921.

(3) Major J. A. G. Crozier, Advisory Clerk Chief, Woods and Forests Branch, appointed December 1st, 1867, and superannuated January 1st, 1921.

(4) W. F. Lewis, Clerk in the Surveys Branch, appointed March 1st, 1872, superannuated January 1st, 1921.

(5) W. Carrell, Engrossing Clerk, Lands Branch, appointed December 18th, 1899, superannuated May 1st, 1921.

(6) H. E. Johnston, Chief Clerk, Military Branch, appointed March 25th, 1905, and superannuated May 1st, 1921.

(7) C. S. Jones, Clerk of Patents, appointed May 22nd, 1896, and superannuated July 1st, 1921.

(8) D. G. Ross, Accountant, appointed April 15th, 1861, and superannuated June 1st, 1921.

(9) R. H. Hodgson, Clerk in Woods and Forests Branch, appointed October 15th, 1903, and superannuated October 31st, 1921.

(10) J. J. Murphy, Advisory Chief Clerk, Lands Branch, appointed May 1st, 1872, and superannuated October 31st, 1921.

Of the above, it is observed that Messrs. Ross, Crozier, Lewis and Murphy each served a half century or more in the service of the Crown, Mr. Ross having been appointed prior to Confederation Major Crozier having entered the Provincial service in Confederation year, and Mr. Lewis and Mr. Murphy in the early part of 1872.

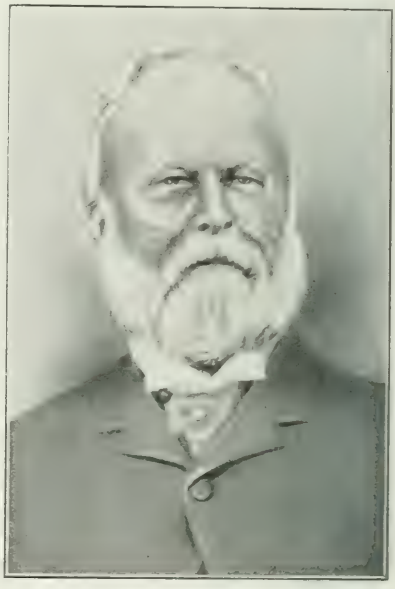
These officials faithfully served the Crown's interests all these years and ably assisted the various administrations in the numerous projects towards the development of the Crown Lands, and were responsible in no small measure for the important statutes and regulations governing the disposition of Ontario's natural resources. While their severance from the Department is keenly felt.

there is a satisfaction that they take their departure in the knowledge of duty well done. It is a pleasure to record that each of these officials under the Superannuation Act is provided with an annuity to assist in declining years and to partially compensate for the untiring efforts devoted to the interests of the Crown.

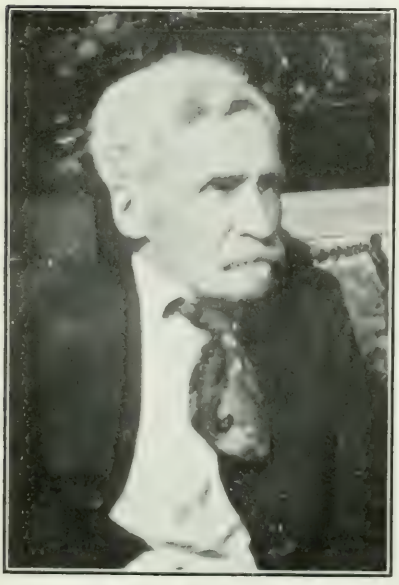
BENIAH BOWMAN,
Minister.

Department of Lands and Forests,
Toronto, October 31st, 1921.

MAJOR J. A. G. CLOZIER



W. F. LEWIS



D. GEO. ROSS

J. J. MURPHY

APPENDICES

Appendix No. 1.

Return of Officers and Clerks of the Department of Lands and Forests, for the year ending October 31st, 1921.

Branch.	Name.	Designation.	When Appointed.	Salary per annum.	Remarks.
	Hon. B. Bowman	Minister	1919, Nov. 14	$6,000 00	
	Albert Grigg	Deputy Minister	1915, Oct. 18	5,100 00	Resigned September 30, 1921.
	W. C. Cain	do do	1903, Mar. 1	4,800 00	
	F. J. Niven	Minister's Secretary and Secretary to Department	1897, May 27	3,000 00	
	F. E. Titus	Law Clerk	1920, Mar. 2	3,500 00	
	W. A. Fleming	Clerk	1914, Apr. 30	1,100 00	Resigned January 31, 1921.
	M. E. Bliss	Stenographer and Filing Clerk to Deputy Minister	1909, Aug. 16	1,200 00	
	R. P. Ferguson	Clerk and Stenographer	1918, Apr. 2	1,100 00	
	B. Beley	Stenographer	1920, Jan. 5	1,050 00	Resigned June 15, 1921.
	Eva Harrison	do	1920, May 14	1,050 00	
	B. Lankin	Messenger	1921, Jan. 11	700 00	
	J. J. Murphy	Advisory Chief Clerk	1872, May 1	2,300 00	Superannuated October 31, 1921
	S. Draper	Chief Clerk	1900, May 1	2,400 00	
	H. E. Johnston	Clerk of Military Grants	1905, Mar. 25	1,900 00	Superannuated May 1, 1921.
	W. R. Ledger	Principal Clerk	1894, Feb. 15	2,200 00	
	C. E. Burns	do do	1897, July 29	2,200 00	
	W. S. Sutherland	Senior Clerk	1900, Mar. 18	1,900 00	
	J. B. Proctor	do do	1897, Jan. 15	1,800 00	
	J. E. Drinkwater	do do	1915, Oct. 19	1,700 00	
	F. A. Lucas	Clerk	1906, Dec. 18	1,600 00	
	S. A. Platt	do	1905, June 12	1,600 00	
	C. S. Jones	Clerk of Patents	1890, May 22	2,150 00	Superannuated July 1st, 1921.
Lands Branch	W. Carrell	Engrossing Clerk	1899, Dec. 18	1,600 00	Superannuated May 1st, 1921
	V. E. Robillard	do do	1891, May 4	1,600 00	
	A. E. Roe	Clerk of Registers	1906, Oct. 16	1,700 00	
	F. W. Bindon	Clerk	1915, Jan. 26	1,600 00	
	S. Mulholland	do	1918, May 6	775 00	
	S. Ross	Stenographer	1917, July 9	1,100 00	
	M. Bengough	do	1896, Oct. 23	1,200 00	
	E. F. O'Neil	do	1902, July 7	1,100 00	
	E. G. Halliday	do	1907, Feb. 21	1,100 00	
	B. M. Benson	do	1909, May 25	1,100 00	
	E. Hills	do	1912, July 2	1,100 00	
	E. Singleton	do	1917, Apr. 16	975 00	

Surveys Branch	L. V. Rorke	Director	1909, May 1	4,200 00	
	J. Hutcheon	Surveyor and Draughtsman	1913, Apr. 1	3,150 00	
	W. F. Lewis	Clerk	1872, Mar. 1	1,400 00	Superannuated January 1, 1921.
	D. G. Boyd	Draughtsman	1896, Oct. 16	2,200 00	
	E. M. Jarvis	Clerk	1897, Apr. 25	1,650 00	
	B. Rushford	Draughtsman	1910, Jan. 24	1,700 00	
	F. E. Blanchet	do	1906, May 15	1,700 00	
	A. Leaman	do	1907, Sept. 12	1,700 00	
	H. Treeby	do	1896, June 25	1,800 00	
	J. Work	do	1909, May 18	1,900 00	
	M. H. Kirkland	Stenographer	1902, July 21	1,100 00	
	C. O'Connor	do	1907, Oct. 16	900 00	
	E. C. Armer	do	1909, Aug. 6	1,050 00	
Woods and Forests	J. A. G. Crozier	Advisory Chief Clerk	1867, Dec. 1	2,300 00	Superannuated January 1, 1921.
	J. Houser	Chief Clerk	1905, July 17	2,400 00	
	J. B. Cook	Clerk	1894, Aug. 7	1,950 00	Superannuated January 1, 1921.
	H. Gillard	do	1897, Dec. 6	1,900 00	
	W. F. Trivett	do	1900, June 25	2,000 00	
	A. H. O'Neil	do	1906, July 19	1,600 00	
	R. H. Hodgson	do	1903, Oct. 15	1,450 00	Superannuated November 1, 1921
	S. D. Meeking	do	1910, Feb. 8	1,400 00	
	E. H. Telfer	do	1915, Sept. 27	1,400 00	
	E. H. Squire	do	1916, Jan. 4	1,300 00	
	M. C. Rowland	Stenographer	1912, May 1	1,100 00	
	S. O. Dennis	do	1910, Mar. 2	1,100 00	
	J. McCort	do	1918, Feb. 28	975 00	
	J. Ferguson	do	1919, Aug. 4	850 00	
Accounts	D. G. Ross	Accountant	1861, Apr. 15	3,000 00	Superannuated June 1, 1921.
	H. M. Lount	do	1903, Oct. 1	2,550 00	
	C. J. Clarke	Clerk	1905, Aug. 9	1,600 00	
	R. Gordon	do	1912, July 30	1,400 00	
	W. A. Burritt	do	1907, Sept. 24	1,600 00	
	C. Bowland	Clerk and Stenographer	1908, July 9	1,100 00	
	M. A. Whyte	do do	1921, June 1	900 00	

Appendix No. 1.—Concluded.

Return of Officers and Clerks of the Department of Lands and Forests, for the year ending October 31st, 1921.

Branch.	Name.	Designation.	When Appointed.	Salary per annum.	Remarks.
Records Branch	S. K. Burdin	Chief Clerk	1916, Apr. 6	2,500 00	
	C. Dies	Clerk	1905, Oct. 2	1,500 00	
	F. Samuels	do	1903, Dec. 5	1,500 00	
	C. W. St. John	do	1906, July 9	1,400 00	
	A. Ferguson	do	1915, Dec. 15	1,600 00	
	W. B. Baines	do	1912, Apr. 9	1,400 00	
	J. T. Lee	do	1917, June 25	1,400 00	
	N. Mathewson	do	1915, May 7	1,300 00	
	H. Brophy	Mailing Clerk, etc.	1898, Oct. 1	1,300 00	
Forestry.	E. J. Zavitz	Provincial Forester	1912, Nov. 7	4,500 00	
	C. R. Mills	Assistant Provincial Forester	1921, Mar. 28	3,000 00	
	F. S. Newman	Forester	1913, Sept. 22	2,300 00	
	G. W. Harris	Clerk	1906, Sept. 1	1,500 00	
	N. L. Rogers	do	1911, Aug. 1	1,700 00	
	J. Bald	Stenographer	1913, June 12	1,100 00	
	V. M. Bassford	do	1920, June 1	900 00	
Colonization Roads	C. H. Fullerton	Superintendent	1915, Oct. 15	4,400 00	
	M. P. Doherty	Accountant and Chief Clerk	1898, May 1	2,100 00	
	C. H. Meader	Surveyor and Draughtsman	1912, June 14	2,400 00	
	J. H. Bradshaw	Clerk	1884, June 10	1,400 00	Superannuated January 1, 1921.
	A. Gamey	do	1915, July 19	1,200 00	
	P. Godkin	Stenographer	1917, Aug. 27	1,050 00	Resigned, December 31, 1920.

H. M. LOUNT,
Accountant.

W. C. CAIN,
Deputy Minister of Lands and Forests.

Appendix No. 2.

List of Agents for the year ending October 31st, 1921.

Name.	Post Office Address.	District or County.	Date of Appointment.	Salary per annum.	Remarks.
		Land Agents.			
Anderson, T. V.	Hearst	Part District of Algoma	1913, May 9	$ 800 00	Resigned April 30, 1921.
Arthurs, E.	Espanola Mills	do do do	1915, May 7	500 00	
Baker, R. H.	Minden	Part Victoria	1907, Oct. 1	350 00	
Bolger, J. W.	New Liskeard	Lake Temiskaming, District of Nipissing	1913, July 17	1,200 00	
Both, C.	Denbigh	Part of Frontenac and Addington	1905, Oct. 20	200 00	
Brown, John	Markstay	Part of District of Nipissing and Sudbury	1916, June 27	600 00	
Brown, J. B.	Bracebridge	Muskoka District	1905, July 28		For salary see Homestead Inspectors.
Blank F.	Wilno	Part District of Renfrew	1921, Apr. 1	500 00	
Cameron, W.	Scratton Station	do do Rainy River	1911, Apr. 27	500 00	
Campbell, I. M.	Parry Sound	do do Parry Sound	1914, Nov. 12	500 00	
Dean, Thos.	Sault Ste. Marie	do do Algoma	1920, Nov. 18	300 00	
Dempsay, S. J.	Cochrane	do do Nipissing	1911, Feb. 9	1,100 00	
Dodds, T.	Thessalon	do do Algoma	1915, May 4	500 00	
Douglas, W. J.	Maynooth	do Hastings	1912, June 12	500 00	
Ellis, H. J.	Powassan	do District of Parry Sound	1909, May 21	500 00	
Freeborn, Dr. J. S.	Magnetawan	do do do	1905, Nov. 10	500 00	
Gibson, J. E.	Dryden	do do Rainy River	1914, Nov. 20	1,000 00	
Ginn, F. E.	Matheson	Part District of Nipissing	1912, Mar. 20	1,200 00	Resigned July 1, 1921.
Hales, W.	Aspley	do County of Peterborough	1911, July 20	250 00	
Hollands C. J.	Fort Frances	do Townplot of Alberta and District of Rainy River	1892, Oct. 12	300 00	
Holland, H. E.	Kenora	do District of Rainy River	1921, Jan. 1	600 00	Also Mining Recorder.
McFayden, A.	Emo	do do do	1905, Sept. 8	600 00	
MacLennan, J. K.	Sudbury	do do Sudbury	1905, July 3	700 00	
Mills, Jos. E.	Matheson	do do Nipissing	1921, Aug. 1	1,200 00	
O'Flaherty, T. F.	Kenora	do do Rainy River	1920, May 10	600 00	Also Mining Recorder, Resigned January 1, 1921.
O'Donnell, J. L.	Hearst	do do Algoma	1921, May 3	800 00	
Parsons, W. J.	North Bay	do do Nipissing	1908, Apr. 8	1,000 00	
Philion, J. A.	Sturgeon Falls	do do do	1907, Sept. 13	500 00	
Small, R.	Mattawa	do do do	1910, June 30	500 00	
Teasdale, R. A.	Massey	do do Sudbury	1917, July 1	600 00	
Thaw, D.	Emsdale	do do Parry Sound	1919, July 2	500 00	
Watt, F.	Pembroke	do Renfrew	1913, May 28	300 00	
Whybourne, W. E.	Marksville	do St. Joseph Island	1905, Apr. 7	300 00	

Appendix No. 2—Concluded.

List of Agents for the year ending October 31st, 1920.

Name	Post Office Address.	District or County.	Date of Appointment.	Salary per annum.	Remarks.
Wilson, A. N.	Kinmount	Part District of Peterborough	1915, June 1	$ 175 00	
Woollings, J.	Englehart	do do Nipissing	1908, June 30	800 00	
McArthur, T. A.	North Bay	Inspector of Crown Lands Offices	1912, May 1	900 00	Also Inspector of Mining Recorders' Offices.
		Homestead Inspectors.			
Barr, J.	Fort Frances	District of Rainy River	1906, Nov. 23	1,400 00	
Bastien, J. A.	Chelmsford	W. Part of Sudbury District	1913, May 2	1,200 00	
Brown, J. B.	Bracebridge	Muskoka District	1905, July 28	1,100 00	Also Crown Lands Agent.
Cragg, W. V.	New Liskeard	S. Part of Temiskaming District	1913, Mar. 27	1,400 00	
Dean, T.	Sault Ste. Marie	Algoma District	1908, July 29	900 00	Also Crown Lands Agent.
Hughes, T.	Murillo	Thunder Bay District	1908, July 20	1,300 00	
Jervis, H. E. J. W.	Callander	District of Parry Sound	1920, June 10	1,500 00	
Owens, H. B.	Cache Bay	E. Part Sudbury and W. Part Algoma Districts	1918, June 25	1,000 00	
Smith, D.	Cochrane	N. part of Temiskaming District	1912, Apr. 16	1,700 00	
Van Horn, I. E.	Monteith	Part Temiskaming and Algoma Districts	1920, Jan. 27	1,500 00	
Watson, T. P.	Englehart	Centre part of Temiskaming District	1905, May 10	1,400 00	
Wilde, R. G.	Dryden	Kenora District	1914, May 27	1,400 00	
		Timber Agents.			
Christie, W. P.	Parry Sound	Part Parry Sound and Muskoka Districts	1903, Dec. 4	1,700 00	
Darby, E. J.	Ottawa	Part Ottawa District	1889, July 26	1,500 00	Superannuated Jan. 1, 1921.
Hawkins, S. J.	Webbwood	Part Algoma and Sudbury Districts	1905, Aug. 16	1,900 00	
Henderson, C.	Sudbury	do do do	1902, Jan. 1	2,100 00	Superannuated Jan. 1, 1921.
Huckson, A. H.	Sault Ste. Marie	Part District of Algoma	1914, Apr. 1	2,100 00	
Jones, W. M.	Fort Frances	Rainy River District	1918, Nov. 15	1,700 00	Retired from office, July 1, 1921
Lerose, S. C.	Ottawa	Part Ottawa District	1890, May 8	1,800 00	
MacDonald, S. C.	New Liskeard	Part Temiskaming District	1907, Jan. 1	2,000 00	
Murgach, W.	Kenora	Kenora District	1889, May 16	1,600 00	Superannuated Jan. 1, 1921.
McDonald, H.	Thessalon	Part District of Algoma	1905, Apr. 20	1,500 00	Superannuated Nov. 1, 1921.
McDougall, J. T.	North Bay	Nipissing and part Sudbury Districts	1908, July 8	2,100 00	
Oliver, J. A.	Port Arthur	Thunder Bay District	1905, Sept. 30	1,850 00	Resigned Oct. 31, 1921.
Spence, D.	Cochrane	Part Temiskaming and Algoma Districts	1920, Dec. 1	2,300 00	
Stevenson, A.	Peterborough	Belleville District	1905, Oct. 4	1,800 00	
Wood, W. G. A.	South Porcupine	Porcupine District	1917, Feb. 28	1,600 00	

H. M. LOUNT,
Accountant.

W. C. CAIN,
Deputy Minister of Lands and Forests.

Appendix No. 3.

Statement of Lands Sold and Leased. Amount of Sales and Leases and Amount of Collections for the year ending October 31st, 1921.

Service.	Acres sold and leased.	Amount of sales and leases.	Collections on sales and leases.
		$ c	$ c
Lands Sold:			
Agricultural and Townsites	139,026.86	143,059 02	135,862 27
Clergy Lands	12.50	31 25	612 90
Common School Lands			3,447 80
Grammar School Lands	57.50	28 75	529 84
University Lands	836.38	418 25	1,917 67
Lands Leased:			
Crown	20,524.85	2,286 50	56,588 93
Temagami	21.00	222 50	900 50
	160,479.09	146,046 27	199,859 91

H. M. LOUNT,
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W. C. CAIN,
Deputy Minister of Lands and Forests.

Appendix No. 4.

Statement of Revenue of the Department of Lands and Forests for the year ending October 31st, 1921.

Service.	$ c	$ c	$ c
LAND COLLECTIONS.			
Crown Lands.			
Agricultural	115,838 91		
Townsites	20,023 36		
		135,862 27	
Clergy Lands	612 90		
Common School Lands	3,447 80		
Grammar School Lands	529 84		
University Lands	1,917 67		
		6,508 21	
			142,370 48
Rent:			
Crown Leases		55,017 03	
Algonquin Provincial Park		1,450 40	
Temagami Leases		900 50	
Sand and Gravel		121 50	
			57,489 43
WOODS AND FORESTS.			
Bonus		1,555,770 69	
Timber Dues		1,921,356 95	
Ground Rent		99,245 12	
Transfer Fees		5,810 00	
Fire Protection		181,257 72	
			3,763,440 48
Parks:			
Algonquin Provincial Park		14,346 44	
Rondeau Provincial Park		1,902 20	
Quetico Provincial Park		1,043 21	
			17,291 85
Casual Fees		1,683 63	
Cullers' Fees		176 00	
Forest Reserves Guides' Fees		161 00	
			2,020 63
REFUNDS.			
Fire Ranging		12,561 46	
Forest Ranging		39,438 82	
Colonization Roads Contingencies		400 00	
Reforestation		325 00	
Agents' Salaries		200 00	
Contingencies, Lands		160 30	
Travelling Expenses, Lands		49 49	
			53,135 07
			4,035,747 94

H. M. LOUNT,
Accountant.

W. C. CAIN,
Deputy Minister of Lands and Forests.

Appendix No. 5.

Statement of Receipts of the Department of Lands and Forests for the year ending October 31st, 1921, which are considered as Special Funds.

Service.	$ c.	$ c.
Clergy Lands.		
Principal	323 05	
Interest	289 85	
		612 90
Common School Lands.		
Principal	1,808 51	
Interest	1,639 29	
		3,447 80
Grammar School Lands.		
Principal	333 68	
Interest	196 16	
		529 84
University Lands.		
Principal	1,204 68	
Interest	712 99	
		1,917 67
		6,508 21

H. M. LOUNT,
Accountant.

W. C. CAIN,
Deputy Minister of Lands and Forests.

Appendix No. 6.

Statement of Disbursements of the Department of Lands and Forests for the year ending October 31st, 1921.

Service.	$ c	$ c	$ c
AGENTS' SALARIES AND DISBURSEMENTS.			
Land, $20,717.00.			
Anderson, T. V.	400 00		
Disbursements	105 50		
		505 50	
O'Donnell, J. L.	396 89		
Disbursements	238 00		
		634 89	
Arthurs, E.		500 00	
Baker, R. H.		350 00	
Bolger, J. W.	1,200 00		
Disbursements	181 88		
		1,381 88	
Both, C.		200 00	
Brown, John	600 00		
Disbursements	28 89		
		628 89	
Blank, F.	291 67		
Disbursements	5 50		
		297 17	
Cameron, Wm.	500 00		
Disbursements	70 00		
		570 00	
Campbell, Miss I. M.	500 00		
Disbursements	101 00		
		601 00	
Dean, T.	285 69		
Disbursements	177 40		
		463 09	
Dempsay, S. J.	1,100 00		
Disbursements	269 60		
		1,369 60	
Dodds, Thos.	500 00		
Disbursements	10 00		
		510 00	
Douglas, W. J.		500 00	
Ellis, H. J.		500 00	
Freeborn, J. S.	500 00		
Disbursements	11 45		
		511 45	
Gibson, J. E.	1,000 00		
Disbursements	194 50		
		1,194 50	
Ginn, F. E.	800 00		
Mills, J. E.	300 00		
Disbursements	170 25		
		1,270 25	
Hales, W.	250 00		
Disbursements	20 00		
		270 00	
Hollands, C. J.	300 00		
Disbursements	150 00		
		450 00	
Carried forward		12,708 22	

Appendix No. 6—Continued.

Service.	$ c.	$ c.	$ c.
Brought forward		12,708 22	
AGENTS' SALARIES AND DISBURSEMENTS—*Continued.*			
Land—Concluded.			
O'Flaherty, T. P.	100 00		
Holland, H. E.	500 00		
Disbursements	406 35		
		1,006 35	
McFayden, A.	600 00		
Disbursements	40 59		
		640 59	
MacLennan, J. K.	700 00		
Disbursements	31 50		
		731 50	
Oliver, J. A., Disbursements		442 25	
Parsons, W. J.	1,000 00		
Disbursements	205 50		
		1,205 50	
Philion, J. A.	500 00		
Disbursements	27 67		
		527 67	
Small, R.	500 00		
Disbursements	25 25		
		525 25	
Teasdale, R. A.	600 00		
Disbursements	24 22		
		624 22	
Thaw, D.	500 00		
Disbursements	18 95		
		518 95	
Watt, F.		300 00	
Whybourne, W. E.	300 00		
Disbursements	38 50		
		338 50	
Wilson, A. N.	175 00		
Disbursements	8 00		
		183 00	
Woolings, J.	800 00		
Disbursements	165 00		
		965 00	
Homestead Inspectors, $25,556.58.			
Barr, J. C.	1,400 00		
Disbursements	1,371 14		
		2,771 14	
Bastien, J. A.	1,200 00		
Disbursements	1,029 40		
		2,229 40	
Brown, J. B.	1,100 00		
Disbursements	638 26		
		1,738 26	
Cragg, W. V.	1,400 00		
Disbursements	455 60		
		1,855 60	
Carried forward		29,311 40	

Appendix No. 6—Continued.

Service.	$ c.	$ c.	$ c.
Brought forward		29,311 40	
AGENTS' SALARIES AND DISBURSEMENTS.—*Continued.*			
Homestead Inspectors.—Concluded.			
Dean, T.	900 00		
Disbursements	267 95		
		1,167 95	
Hughes, Thos.	1,300 00		
Disbursements	963 85		
		2,263 85	
Jervis, H. F. J. W.	1,500 00		
Disbursements	916 60		
		2,416 60	
Owens, H. B.	1,000 00		
Disbursements	1,409 15		
		2,409 15	
Smith, D.	1,700 00		
Van Horn, L. E.	1,375 00		
Disbursements	1,148 71		
		4,223 71	
Watson, T. P.	1,400 00		
Disbursements	777 65		
		2,177 65	
Wigle, R. G.	1,400 00		
Disbursements	903 27		
		2,303 27	
Timber, $35,860.70.			
Christie, W. P.	1,700 00		
Disbursements	389 14		
		2,089 14	
Hawkins, S. J.	1,900 00		
Disbursements	138 40		
		2,038 40	
Henderson, C.	349 50		
Hurdman, G. C.	692 30		
MacCrindle, Miss I.	640 00		
Disbursements	651 54		
		2,333 34	
Huckson, A. H.	2,100 00		
McDougall, Miss M.	480 00		
Disbursements	1,036 32		
		3,616 32	
Jones, W. M.	1,133 33		
McDonald, A.	1,600 00		
Alexander, J. A.	632 00		
Disbursements	889 43		
		4,254 76	
MacDonald, S. C.	2,000 00		
Disbursements	237 34		
		2,237 34	
Margach, Wm.	265 34		
Legris, J.	632 68		
Brunsell, Miss E. S.	752 89		
George, Miss J. R.	49 00		
Disbursements	1,173 51		
		2,873 42	
Carried forward		65,716 30	

Appendix No. 6.—Continued.

Service.	$ c.	$ c.	$ c.
Brought forward		65,716 30	
AGENTS' SALARIES AND DISBURSEMENTS—*Concluded.*			
Timber.—Concluded.			
McDonald, H.	1,500 00		
Disbursements	284 47		
		1,784 47	
McDougall, J. T.	2,100 00		
Disbursements	564 63		
		2,664 63	
Oliver, J. A.	1,850 00		
Godfrey, Miss S	885 00		
Conners, Miss M.	18 75		
Disbursements	1,065 96		
		3,819 71	
Spence, D. J.	2,108 33		
Disbursements	1,237 07		
		3,345 40	
Stevenson, A.	1,800 00		
Disbursements	487 39		
		2,287 39	
Whelan, P. J., disbursements		413 37	
Wood, W. G. A.	1,600 00		
Disbursements	503 01		
		2,103 01	
Miscellaneous, $2,103.07.			
Cornwall, Fred T., services collecting rentals at Presqu'ile Point		53 00	
Green, H. P., Caretaker of Islands in Charleston Lake		50 00	
Jamieson, W. H., Caretaker of Islands in Dog and Laboria Lakes		50 00	
Stuart, Joseph, services as Supervisor of Beach at Wellington		50 00	
VanMeer, J. E. inspecting Water Lot front of Twp. Billings		17 00	
McArthur, T. A., Inspector of Agencies	900 00		
Disbursements	983 07		
		1,883 07	
			84,237 35
OTTAWA AGENCY.			
Darby, E. J., Agent		448 50	
LaRose, S. C., Clerk		1,176 31	
Rent	700 00		
Disbursements	81 79		
		781 79	
			2,406 60
CULLERS' ACT.			
McDougall, J. T., disbursements		28 25	
Milway, J. H., disbursements		11 00	
			39 25
Carried forward			86,683 20

Appendix No. 6.—Continued.

Service.	$ c.	$ c.	$ c.
Brought forward			86,683 20
Fire Ranging			547,474 47
Forest Ranging			339,428 11
Forest Reserves			5,277 84
Reforestation			83,372 63
Algonquin Provincial Park			40,705 81
Quetico Provincial Park			13,606 37
Rondeau Provincial Park			15,295 90
Surveys			145,169 99
Colonization Roads			506,180 80
Board of Surveyors			200 00
Grant to Canadian Forestry Association			1,000 00
Annual Membership Fees			66 69
Insurance			1,037 46
Commissions re Sunday Investigations			63,781 05
Workmen's Compensation			3,042 76
Unforeseen and Unprovided			389 45
Special Warrants.			
Legal Fees and Expenses		45,147 67	
Canadian Aero Film Company		6,499 75	
Hurdman, G. C.		5,984 75	
Toronto Exhibition		396 60	
Doherty, L. J.		150 00	
			58,178 77
Miscellaneous.			
Whitson, Mrs. A. M. ....Gratuity		4,500 00	
Law Society of Upper Canada ....Fees		20 00	
			4,520 00
Refunds Miscellaneous			16,656 31
Special Survey, Ontario and Manitoba Boundary Line			12,500 00
Veterans' Commutation			100 00
Clearing Fire Hazards			9,744 81
Clearing Lands, Kapuskasing			5,042 00
Carried forward			1,959,454 42

Appendix No. 6.—Continued.

Service.	$ c	$ c	$ c
Brought forward			1,959,454 42
CONTINGENCIES, PLANS, MAPS, ETC.			
Departmental.			
Printing and Binding	1,409 76		
Stationery	17,092 63		
		18,502 39	
Express	671 32		
Postage	2,536 61		
		3,207 93	
Telegraphing	892 01		
Car Fare	49 00		
		941 01	
Subscriptions	251 47		
Advertising	15,317 83		
		15,569 30	
Typewriter repairs and inspections		364 45	
Extra Clerks	9,597 78		
Maps	7,482 40		
Sundries	337 39		
		17,417 57	
			56,002 65
Travelling Expenses.			
Bowman, Hon. Beniah		827 65	
Grigg, A.		200 00	
Cain, W. C.		157 57	
Niven, F. J.		229 55	
Titus, F. E.		136 06	
Rorke, T. V.		846 86	
Work, J.		132 10	
Boyd, D. G.		39 45	
Hutcheon, J.		621 60	
Ledger, W. R.		31 80	
Larose, S. C.		170 00	
Stevenson, A.		111 85	
			3,504 49
TYPEWRITERS AND OFFICE EQUIPMENT.			
United Typewriter Company			792 14
Forestry Contingencies.			
Printing and Binding	236 47		
Stationery	1,184 97		
		1,421 44	
Postage	386 11		
Telegraphing	204 02		
Express and Cartage	89 13		
Typewriter Inspections and Repairs	33 50		
		712 76	
Extra Clerks	1,883 66		
Supplies	135 16		
Sundries	42 50		
		2,061 32	
			4,195 52
Carried forward			2,023,949 22

Appendix No. 6.—Concluded.

Service.	$ c.	$ c.	$ c.
Brought forward			2,023,949 22
Travelling Expenses.			
Zavitz, E. J.		57 00	
Mills, C. R.		24 10	
			81 10
TYPEWRITERS, OFFICE EQUIPMENT, ETC.			
United Typewriter Company			350 00
COLONIZATION ROADS CONTINGENCIES.			
Printing and Binding	296 63		
Stationery	1,245 67		
		1,542 30	
Postage	4 40		
Express	90		
		5 30	
Telegraphing	84 57		
Subscriptions	18 53		
Typewriter repairs and inspections	69 50		
		172 60	
Extra Clerks	2,556 16		
Sundries	66 25		
		2,622 41	
			4,342 61
Travelling Expenses.			
Meader, Chas. H.			802 39
			2,029,525 32

*For particulars of expenditure of the Northern Development Branch see Appendix No. 46.

H. M. LOUNT,
Accountant.

W. C. CAIN,
Deputy Minister of Lands and Forests.

Appendix

WOODS AND

Statment of Timber and Amounts accrued from Timber Dues, Ground

QUANTITY AND

Agencies.	Area covered by timber licenses.	Saw logs.				
		Pine.		Other.		
	Square Miles.	Pieces.	Feet B.M.	Pieces.	Feet B.M.	Pieces.
Western Timber District	15,401¾	9,395,767	309,648,918	1,333,596	47,626,991	45,961
Belleville Timber District	562¾	94,849	1,551,178	128,117	4,338,986	1,126
Ottawa Timber District	3,891	403,347	18,727,034	504,479	14,845,243	2,483
	19,855½	9,893,963	329,927,130	1,966,192	66,811,220	49,570

General Statement

Agencies.	Tan Bark.	Railway Ties.	Shingle Bolts.	Cedar Posts	Telegraph Poles.	Pulpwood.		
	Cords.	Pieces.	Cords.	Pieces.	Pieces.	Cords.	Transfer Fees.	Interest.
Western Timber District	917	3,987,812	2,503	70,650	15,618	900,845	3,345 00	32,338 24
Belleville Timber District	16	4,224	.....	104	35	169	85 00	157 30
Ottawa Timber District	1,224	9,435	.....	14,555	3,093	27,171	2,380 00	626 14
	2,157	4,001,471	2,503	85,309	18,746	928,185	5,810 00	33,121 68

JOHN HOUSER,
Chief Clerk in Charge.

No. 7.

FORESTS.

Rent and Bonus during the year ending 31st October, 1921.

DESCRIPTION OF TIMBER.

Boom and Dimension.			Square Timber.		Piling.				Cordwood.	
Pine.	Other.								Hard.	Soft.
Feet B.M.	Pieces.	Feet B.M.	Pieces.	Cubic Feet.	Pieces.	Lineal Feet.	Pieces.	Feet B.M.	Cords.	Cords.
5,621,498	26,151	2,956,905	1,425	83,066	1,645	48,187	4,448	438,412	5,103	33,461
143,334	1,717	175,899								
268,733	3,894	448,211	.....	.....	.....	.....	.....	.....	81	3,444
6,033,565	31,762	3,581,015	1,425	83,066	1,645	48,187	4,448	438,412	5,184	36,905

of Timber.—Concluded.

Amounts accrued.

Trespass.	Timber Dues.	Bonus.	Deposit Timber Sales.	Ground Rent.	Fire Protection.	Total.
$ c	$ c	$ c	$ c	$ c	$ c	$ c
66,391 32	2,057,830 24	1,466,358 10	248,150 40	73,332 00	148,495 27	4,096,240 57
677 89	10,798 49	423 90	200 00	3,055 00	3,641 80	19,039 38
2,787 21	93,000 58	.....	.....	22,420 00	29,120 65	150,334 58
69,856 42	2,161,629 31	1,466,782 00	248,350 40	98,807 00	181,257 72	4,265,614 53

W. C. CAIN,
Deputy Minister

Appendix No. 8.

PATENTS OFFICE (Lands Branch).

Statement of Patents, etc., issued from 1st November, 1920, to 31st October, 1921.

Public Lands (late Crown)	523
" " (late School)	15
" " (late Clergy Reserves)	3
" " (University)	3
Free Grant Lands (Act of 1913)	372
" " " (Act of 1901) Veterans	48
Mining Lands (Patents)	285
Mining Leases	170
Crown Leases	26
Licenses of Occupation	92
Temagami Island Leases	5
Sand and Gravel Licenses	21
Pine Patents	8
Quarry Claims	15
Orders-in-Council	1
Total	1,587

CHAS. E. BURNS,
Clerk of Patents.

W. C. CAIN,
Deputy Minister of Lands and Forests.

Appendix No. 9.

WOODS AND FORESTS BRANCH.

Statement of Revenue collected during the year ending October 31st, 1921.

Amount of Western Collections at Department	$3,612,395 59
" Belleville " " "	20,162 02
" Ottawa " " "	130,882 80
	$ 3,763,440 48

WOODS AND FORESTS.

Bonus	1,555,770 69
Timber Dues	1,921,356 95
Ground Rent	99,245 12
Transfer Fees	5,810 00
Fire Protection	181,257 72
	$ 3,763,440 48

TIMBER DUES—AMOUNTS ACCRUED—1920-21.

Western	$ 3,590,579 66
Belleville	11,900 28
Ottawa	95,787 79
	$ 3,698,267 73

WOODS AND FORESTS BRANCH REVENUE.

October 31st, 1921.

WESTERN DISTRICT—		
Timber dues	$ 1,799,838 55	
Bonus	1,306,896 13	
Ground rent	73,332 00	
Interest on dues	31,984 72	
Interest on ground rent	353 52	
Transfer fees	3,345 00	
Timber sale deposit	248,150 40	
Fire protection	148,495 27	
		$ 3,612,395 59
OTTAWA DISTRICT—		
Timber dues	76,336 01	
Ground rent	22,420 00	
Interest on dues	544 24	
Interest on ground rent	81 90	
Fire protection	29,120 65	
Transfer fees	2,380 00	
		$ 130,882 80
BELLEVILLE DISTRICT—		
Timber dues	12,498 83	
Bonus	524 16	
Ground rent	3,055 00	
Interest on dues	154 60	
Interest on ground rent	2 70	
Fire protection	3,641 80	
Transfer fees	85 00	
Timber sale deposit	200 00	
		20,162 09
		$ 3,763,440 48

H. M. LOUNT,
Accountant

J. H. HOUSER,
Chief Clerk in Charge.

W. C. CAIN,
Deputy Minister.

Appendix No. 10.

Memorandum of parties who passed the Cullers' Examination in 1921.

Barker, Gilbert G., Moore Block, Port Arthur, examined at Port Arthur on the 28th day of September, 1921, licensed November 10th, 1921.

Coghlan, John, 201 Bethune St., Fort William, examined at Port Arthur on the 28th day of September, 1921. licensed November 10th, 1921.

Gilmour, William, Braeside, examined at Callander on the 28th day of September, 1921, licensed October 7th, 1921.

King, Douglas, Cumberland Hotel, Port Arthur, examined at Port Arthur on the 28th day of September, 1921, licensed November 10th, 1921.

Kerr, John, Shanley Block, Port Arthur, examined at Port Arthur on the 28th day of September, 1921, licensed November 10th, 1921.

McKinnon, Charles J., 108 Regent St., Port Arthur, examined at Port Arthur on the 28th day of September, 1921, licensed November 10th, 1921.

Watson, Alexander, 336 Conyers St., Port Arthur, examined at Port Arthur on the 28th day of September, 1921, licensed November 10th, 1921.

JOHN HOUSER,
Chief Clerk.

W. C. CAIN,
Deputy Minister.

Appendix No. II.

Statement of the work done in Military Office, Lands Branch of the Department of Lands and Forests, during the year ending October 31st, 1921.

Veteran Patents issued	48
Locations under Military Certificates	27
Certificates applied in payment of lands	2
Certificates surrendered for commutation money	2

J. B. PROCTOR,
Clerk in charge.

SELBY DRAPER,
Chief Clerk.

W. C. CAIN,
Deputy Minister.

Appendix No. 12.

RECORDS BRANCH, 1920-1921.

Communications received:

From Crown Lands Agents	10,485
" Crown Timber Agents	5,370
" Mining Recorders	2,486
" Homestead Inspectors	3,558
" Superintendent Algonquin Park	297
" Superintendent Quetico Park	138
" Superintendent Rondeau Park	141
Orders-in-Council	200
Telegrams	200
Northern Development Branch (figures supplied by them)	8,753
Loan Commissioner (figures supplied by them)	5,555
Forestry Branch (figures supplied by them)	16,136
Colonization Roads (figures supplied by them)	11,678
All other sources	30,258
Total incoming (Minister's Office not included)	95,255

Communications sent out:

To Crown Lands Agents, Inspectors and Park Superintendents	23,732
" General Public	23,268
Circular Letters *re* timber sales	6,832
Maps and Blue Prints	5,475
Northern Development Branch Letters (figures supplied by them)	10,712
" " Branch, Seed Grain (figures supplied by them)	652
Loan Commissioner Letters (figures supplied by them)	8,676
Forestry Branch, Letters (figures supplied by them)	7,694
" " Parcels by post (figures supplied by them)	483
" " Calendars (figures supplied by them)	10,000
Colonization Roads, Letters (figures supplied by them)	6,311
Total outgoing (Minister's Office not included)	103,925

Postage:

Postage for the year, Records Branch	$2,403.04
" " " Loan Commissioner	300.00
" " " Forestry Branch	250.00
" " " Colonization Roads	205.00

Files:

New Files issued, General	6,163
" " " Accounts chargeable	685
" " " Accounts free	253

S. K. BURDIN,
Chief Clerk, Records Branch.

W. C. CAIN,
Deputy Minister.

Appendix No. 13.

Statement showing the number of Locatees and of acres located; of purchasers and of acres sold; of lots resumed for non-performance of the settlement duties; and of patents issued in Free Grant Townships during the year ending 31st October, 1921.

Township.	District or County.	Agent.	No. of persons located.	No. of acres located.	No. of purchasers	No. of acres sold.	No. of persons cancelled.	No. of acres resumed.	No. of patents issued.	No. of acres patented.
Baxter	Muskoka	J. B. Brown, Bracebridge					3	28¾	6	52¾
Brunel	"	"	2	199			3	300	1	100
Cardwell	"	"					1	50	1	200
Chaffey	"	"							4	402
Draper	"	"								
Franklin	"	"	1	104			1	104	2	342
Freeman	"	"	1	195	1	49			2	49½
Macaulay	"	"	2	300			3	404		
Medora	"	"			2	345	1	200	6	108½
Monck	"	"								
Morrison	"	"	2	300			1	200	2	200
Muskoka	"	"	2	300			3	337		
McLean	"	"							1	101
Oakley	"	"	4	504			7	863		
Ridout	"	"	2	140			1	140	1	2¾
Ryde	"	"	1	180			4	681	3	400
Sherborne	Haliburton	"					1	90		
Sinclair	Muskoka	"	1	100			1	100	6	642¼
Stephenson	"	"								
Stisted	"	"	1	77			1	77	1	104
Watt	"	"								
Wood	"	"	1	151	1	47	3	314	1	192¾
Blair	Parry Sound	Miss I. M. Campbell, Parry Sound.							5	59
Burpee	"	"					1	99	2	297¾
Carling	"	"	3	485			3	386	5	415
Christie	"	"	3	384			3	582	1	188
Conger	"	"					1	166	2	60½
Cowper	"	"							0	69
Foley	"	"								
Ferguson	"	"	1	135			2	400	1	209
Hagerman	"	"	1	98½			1	200		
Harrison	"	"			1	2			15	128
Henvey	"	"	3	400			1	200		
Humphrey	"	"			1	98	2	283	1	181
McConkey	"	"	4	541			1	200	2	397
McDougall	"	"	1	100			1	191		
McKellar	"	"	3	300						
McKenzie	"	"			1	45	1	45	4	87
Monteith	"	"	2	267			5	683	2	649
Shawanaga	"	"							1	
Wilson	"	"	6	900			2	300	2	345
Chapman	Parry Sound	Dr. J. S. Lochhart, Magnetawan	2	3[illegible]	1	180	3	364	2	400
Croft	"	"	7	700			4	500	1	100
Ferrie	"	"	1	100			1	100		
Gurd	"	"	2	314					1	100
Lount	"	"	3	387			4	589		
Machar	"	"	2	198			1	99	1	140
Mills	"	"	7	1,295	1	25	1	200	2	107
Pringle	"	"	7	880			4	582	1	200
Ryerson	"	"	2	300			2	300	1	200
Spence	"	"	7	853	1	50½	6	703	2	400
Strong	"	"	1	100						

Appendix No. 13—Continued

Township	District or County	Agent	No. of persons located	No. of acres located	No. of purchasers	No. of acres sold	No. of pers'ns cancelled	No. of acres resumed	No. of patents issued	No. of acres patented
Armour	Parry Sound	David Thaw,	1	100			1	103	2	193
Bethune	"	Emsdale	2	200			3	594	1	58
Joly	"	"	15	2,127			7	1,004	5	722
McMurrich	"	"	1	103			3	404		
Perry	"	"								
Proudfoot	"	"							1	113
Hardy	Parry Sound	H. J. Ellis,	9	1,732	1	2	2	300	1	200
Himsworth	"	Powassan	5	599			6	600	1	32
Laurier	"	"	3	254	1	5	1	100	3	296½
Nipissing	"	"	1	100			1	200	2	200
Patterson	"	"							2	6
Bonfield	Nipissing	W. J. Parsons,	13	1,822	2	24½	7	797	3	402½
Boulter	"	North Bay	4	504	1	2			1	201
Chisholm	"	"	4	581			1	203	3	394
Ferris	"	"	4	400	1	50	7	686	6	599
Anson	Haliburton	R. H. Baker,	1	96			1	96	1	100
Glamorgan	"	Minden	2	167	1	90	1	99	1	3
Hindon	"	"								
Lutterworth	"	"							1	85
Minden	"	"					1	88	3	294
Snowdon	"	"	1	136			1	100	3	486
Stanhope	"	"	1	98			1	20	2	200
Anstruther	Peterborough	William Hales,	1	137			3	507		
Burleigh, N.D.	"	Apsley	3	298						
" S.D.	"	"								
Chandos	"	"	3	307			2	200	2	160
Methuen	"	"					1	125		
Cardiff	Haliburton	A. N. Wilson,	1	200			2	371	2	105
Cavendish	Peterborough	Kinmount	2	190	1	4	1	88	4	119,3[illegible]
Galway	"	"	5	572			5	533	2	203
Monmouth	Haliburton	"	3	292			5	586	4	497
Bangor	Hastings	W. J. Douglas,	2	230			3	294	1	101
Carlow	"	Maynooth	1	88					3	448
Cashel	"	"							1	100
Dunganno	"	"					2	286	2	312
Faraday	"	"	7	879			7	782	3	396½
Herschel	"	"	6	650			6	750	1	100
Limerick	"	"			1	59	1	95		
Mayo	"	"	5	369			2	249	1	194
Monteagle	"	"	1	52	2	101			2	251½
McClure	"	"							3	222½
Wicklow	"	"	2	100			1	95	3	571
Wollaston	"	"	2	200					1	100
Algona, S.	Renfrew	Frank Blank,					1	100	1	100
Brougham	"	Wilno					1	91		
Brudenell	"	"					2	228	3	287
Burns	"	"					1	100	1	182
Grattan	"	"							2	402
Griffith	"	"							1	100
Hagarty	"	"	1	79			1	100		
Jones	"	"	4	346½			1	182	1	49
Lyell	"	"	2	100			1	200	1	7
Lyndoch	"	"	6	607			1	50½	6	798½

Appendix No. 13—Continued

Township	District or County	Agent	No. of persons located	No. of acres located	No. of purchasers	No. of acres sold	No. of persons cancelled	No. of acres resumed	No. of patents issued	No. of acres patanted
Matawatchan	Parry Sound	Frank Blank, Wilno	3	313			2	230	5	1,766
Radcliffe	"	"	6	932			5	671	1	100
Raglan	"	"	5	598	1	48	2	251	4	380
Richards	"	"	6	555			6	663	2	67
Sebastopol	"	"							3	381
Sherwood	"	"	7	892	1	100	7	765	2	250
Algona, N.	Renfrew	Finlay Watt,	2	309			1	100	2	309½
Alice	"	Pembroke							3	186
Buchanan	"	"	2	331			2	368	9	1,490
Clara	"	"	2	257			1	257	1	181
Fraser	"	"	1	100						
Head	"	"							1	100
Maria	"	"								
McKay	"	"								
Petawawa	"	"							2	148¾
Rolph	"	"							1	56
Wilberforce	"	"			1	100	1	100	1	100
Wylie (pt.)	"	"							1	98¾
Calvin	Nipissing	Robert Small,	1	100			1	100	1	200
Cameron (pt.)	"	Mattawa	6	602			2	202	1	135
Lauder	"	"	3	520			2	310	1	2
Mattawan	"	"	8	978			4	487	1	101
Papineau	"	"	11	1,250			7	800	1	100
Korah	Algoma	Thos. Dean,	1	80					1	80
Parke	"	Sault Ste. Marie								
Prince	"	"					1	160	3	480
Aberdeen	Algoma	Thos. Dodds,			1	161	1	163¾	3	329½
" ad	"	Thessalon	3	319½			2	320		
Galbraith	"	"	2	305½			2	305½	2	198
Lefroy	"	"			1	33				
Plummer	"	"								
" ad	"	"								
St. Joseph Is'd.	Algoma	W. E. Whybourne,	8	778			7	778	1	99
St. Joseph Channel Is'd.	"	Marksville			1	10			1	10
Baldwin	Sudbury	Edward Arthurs,	6	964½			6	971½		
Merritt	"	Espanola	13	1,747½			2	322	6	310½
Blake	Thunder Bay	J. A. Oliver (acting)	10	1,600			10	1,546	2	240
Conmee	"	Port Arthur	5	503	1	1	12	1,612½	11	1,655¼
Crooks	"	"	2	318			5	763½	10	1,381
Dawson Road	"	"	6	562	1	1	15	1,688	4	167½
Dorion	"	"	1	160			2	277¾	3	487½
Gillies	"	"	1	79			2	159¾	2	241½
Gorham	"	"	8	1,312½	3	255	7	1,109½	18	2,770¼
Lybster	"	"	3	240	1	166	1	160½	7	837½
Marks	"	"	4	624½			2	300	2	317½
McGregor	"	"	3	482			6	1,079	4	838
McIntyre	"	"								
O'Connor	"	"	2	323			1	161	4	740½
Oliver	"	"	2	318			4	640	2	267½
Paipoonge, N.R.	"	"							1	90
" S.R.	"	"							1	100
Pardee	"	"	3	502	1	39¼	3	400		
Pearson	"	"	9	1,365½			24	3,745½	5	821½

Appendix No. 13—Continued

Township	District or County	Agent	No. of persons located	No. of acres located	No. of purchasers	No. of acres sold	No. of persons cancelled	No. of acres resumed	No. of patents issued	No. of acres patented
Scoble	Thunder Bay	J.A.Oliver, (acting)	9	1,447½	1	77½	17	2,607½	5	771
Stirling	"	Port Arthur	24	3,246¼	4	381¼	17	2,279	2	231¼
Strange	"	"	1	163	1	149	1	159	2	320½
Ware	"	"	11	1,588	4	447¼	10	1,398	17	2,499½
Atwood	Rainy River	Wm. Cameron,								
Blue	"	Stratton	10	1,087½			10	1,334	3	366½
Curran	"	"	2	322			2	322		
Dewart	"	"	15	2,098¾			10	1,567½		
Dilke	"	"	1	80			1	80	2	320
Morley	"	"	2	244½	1	4	3	324½		
Morson	"	"	11	1,564½	4	352	19	2,865½		
McCrosson	"	"	6	597¾	1	80	7	989½		
Nelles	"	"	10	1,419½			17	2,261½	2	162
Patullo	"	"	11	1,527	1	2	13	1,694	4	566
Pratt	"	"	2	283			2	339½	2	339½
Roseberry	"	"								
Shenston	"	"	1	160			2	241	1	127
Sifton	"	"	10	1,556½	2	160	9	1,574	3	319½
Spohn	"	"	6	785			11	1,427½	2	158½
Sutherland	"	"	14	2,188¾	1	39¾	12	1,878½	2	248½
Tait	"	"	6	629	3	243	7	881	4	545
Tovell	"	"	4	657	2	199	3	480	1	78¼
Worthington	"	"								
Aylesworth	Rainy River	Alex. McFayden,					1	81		
Barwick	"	Emo								
Burriss	"	"	1	200½			1	200½	4	670½
Carpenter	"	"	3	534			4	555½	2	318½
Crozier	"	"	1	40½			3	362½		
Dance	"	"	4	676			3	515	1	159½
Devlin	"	"	1	162			1	164	3	368½
Dobie	"	"	3	409½			1	160½	4	580
Fleming	"	"	2	320½			1	160		
Kingsford	"	"	9	1,380½			11	1,673	4	583
Lash	"	"	3	285			2	204	1	160
Mather	"	"	3	414¼			1	159	4	664
Miscampbell	"	"							1	159½
Potts	"	"	4	596			5	757½	1	120
Richardson	"	"	1	160½	1	88	2	356	2	367
Roddick	"	"								
Woodyatt	"	"							5	704
Aubrey	Kenora	J. E. Gibson,	21	2,888½			10	1,341½	5	537¼
Britton	"	Dryden	7	1,023			2	225	1	160
Eton	"	"	25	3,907½	1	80	7	989½	1	157
Langton	"	"	1	160			3	485	1	3
Melgund	"	"	12	1,750½	1	167½	7	836	2	312½
Mutrie	"	"	4	541½			4	603		
Redvers	"	"	2	283½			3	437	2	429¾
Rowell	"	"	2	195					1	120
Rugby	"	"	16	2,559			6	880		
Sanford	"	"	27	4,184¼			9	1,435½	7	1,039½
Southworth	"	"	8	1,200			2	293		
Temple	"	"	5	704			3	444	1	160
Van Horne	"	"					1	116	3	543¼
Wabigoon	"	"	18	2,482¾			9	1,385	1	67½
Wainwright	"	"	8	1,037½	1	27	4	554¾	3	272
Zealand	"	"	19	2,461¼	1	76	20	3,019	1	162

Appendix No. 13—Continued

Township	District or County	Agent	No. of persons located	No. of acres located	No. of purchases	No. of acres sold	No. of pers. cancelled	No. of acres resumed	No. of patents issued	No. of acres patented
Meliek	Kenora.....	H. E. Holland,	24	3,859	1	80	5	824	1	70
Pellatt	"	Kenora...	6	964		.....	4	481½	4	479
Balfour	Sudbury	J. K. MacLennan,								
Blezard	"	Sudbury..	2	323					2	154¾
Broder	"	"					1	149		
Capreol	"	"	3	394¾			6	794¾	1	40
Chapleau	"	"							1	685
Dill	"	"	3	471½			2	293	2	235½
Garson	"	"					1	150	1	162
Hanner	"	"	5	624¾			4	598¾		
Lumsden	"	"	2	319½			1	160	1	80
Morgan	"	"	1	74½					2	154¾
Neelon	"	"							2	180⅞
Rayside	"	"	1	160			1	160	1	160
Appelby	Sudbury	John Brown,	12	1,789½			5	721	3	404
Casimir	"	Markstay..	5	738			2	318½	1	159½
Dunnet	"	"	4	641			1	160	4	606½
Hagar	"	"	24	3,713½			13	1,989		
Jennings	"	"	5	717			2	315	1	161½
Kirkpatrick	"	"	1	157½					2	234½
Ratter	"	"	5	789			3	448½	1	105
Caldwell	Nipissing	J. A. Philion,	2	424½			3	637	4	544½
Cosby	"	Sturgeon Falls..	4	593					1	160
Grant	"	"	3	396½			1	76½		
Macpherson	"	"	3	454			1	160		
Martland	"	"	5	663			4	507½	5	716½
Springer	"	"	1	160			2	406	3	275
Abinger	Lennox and Addington	Charles Both,	2	176			3	400		
Canonto, S	Frontenac	Denbigh	1	73						
" N	"	"	1	40						
Clarendon	"	"					1	105	1	100
Denbigh	Lennox and Addington	"	2	189						
Miller (pt.)	"	"	2	184					1	100
Palmerston	"	"							2	317
McClintock	Haliburton	Unattached								
Airy	Nipissing	"	4	398			1	92	2	507½
Finlayson	"	"			1	48			2	482½
Murchison	"	"	1	46					1	267
Sabine	"	"	2	194			1	100	5	692
O'Brien	Temiskaming	"			52	4,652	54	4,865		
Owens	"	"			14	1,185	4	290		
Williamson	"	"								
			868	118 637½	132	10202¾	761	102,913¼	500	60,180½

No. of lots assigned ..... 253 No. of acres assigned 33,324¼

List showing number of locations by Returned Soldiers in Sale and Free Grant Territory, respectively, and number where arrears due Crown were remitted.

District.	Agency.	Number locations.	No. of arrears remitted.	Total
	In Sale Territory.			
Algoma	Hearst	58	1	
"	Unattached	1		
Temiskaming	Englehart	21	8	
"	Cochrane	107		
"	Elk Lake	1		
"	Haileybury	1		
"	Matheson	34		
"	New Liskeard	3		
"	Hearst	2		
"	Unattached	5		
Sudbury	Massey	10	1	
"	Unattached	1		
Nipissing	North Bay	3		
		247	10	
				257
	In Free Grant Territory.			
Sudbury	Unattached	52		
Temiskaming	"	2		
Algoma	Marksville	1		
		55		
				55

Statement showing number of lots resumed for non-performance of settlement duties by, or on behalf of Returned Soldiers.

		In Sale Territory. No. of lots	Total
Temiskaming	Unattached	3	
"	Cochrane	11	
"	New Liskeard	1	
"	Englehart	2	
"	Matheson	2	
Algoma	Hearst	11	
Thunder Bay	Unattached	1	
			31
	In Free Grant Territory.		
Temiskaming	Unattached	3	
Rainy River	Stratton	2	
Thunder Bay	Port Arthur	1	
			6
		37	
			37

Appendix No. 13—Continued

ISLANDS SOLD.

Part or Parcel.	Township.	District or County	Agent.	No. of Acres Sold.
B 278	Conger	Parry Sound	Miss I. M. Campbell.	4.30
Pt. 30a	Harrison	"	"	12.
Pt. 358a	"	"	"	.30
Pt. 265c	Carling	"	"	.50
Pt. B 715	Cowper	"	"	11.
75a	Shawanaga	"	"	.12
B 503	Cowper	"	"	1.
B 477	"	"	"	41.
B 501a	"	"	"	1.1
Bob Island	Medora	Muskoka	J. B. Brown	.10
Eleanor Island	"	"	"	.12
Pt. 300c	Carling	Parry Sound	Miss I. M. Campbell.	14.
Leslie Island	Medora	Muskoka	J. B. Brown	.29
Island B	Cowper	Parry Sound	Miss I. M. Campbell.	4.20
Bedford Island	St. Joseph's Channel	Algoma	W. E. Whybourne	10.
Pt. No. 133	Patterson	Parry Sound	H. J. Ellis	5.
Pt. No. 133	"	"	"	1.
Pt. B 509	Cowper	"	Miss I. M. Campbell.	.50
Pt. B 369	Conger	"	"	56.
Pt. C 270	Carling	"	"	.66
Wright Island	Finlayson	Nipissing	Unattached	29
Pt. 15a	Harrison	Parry Sound	Miss I. M. Campbell.	6.6
Pt. 782a	"	"	"	5.45
Pt. 11a	"	"	"	6.
Island B	Cowper	"	"	1.1
Big Island	Chandos	Peterboro	Wm. Hales	.37
Hawk Island	"	"	"	.23
B 485	Cowper	Parry Sound	Miss I. M. Campbell.	3.1
Pt. Island 27a	Harrison	"	"	21.
Pt. Island 22	Langton	Kenora	J. E. Gibson	3.1
				209.55

Appendix No. 13—Concluded

ISLANDS PATENTED.

Part or Parcel.	Township.	District or County.	Agent and P.O. Address.	No. of Acres Patented.
Island opp. Lot 20, Con. 7	Baxter	Muskoka	J. B. Brown, Bracebridge	5.
Island 358a	Harrison	Parry Sound	Miss I. M. Campbell, Parry Sound	.30
Island B 715	Cowper	"	Miss I. M. Campbell, Parry Sound	11.
Island 75a	Shawanaga	"	Miss I. M. Campbell, Parry Sound	.12
Miller Island	Mowat (in front of)	"	Miss I. M. Campbell, Parry Sound	18.
Pt. Franklin Isld.	Carling	"	Miss I. M. Campbell, Parry Sound	14.
Lister Island	Medora	Muskoka	J. B. Brown, Bracebridge	.29
Island B 404	Cowper	Parry Sound	Miss I. M. Campbell,	4.20
Island 17	St. Joseph Channel	Algoma	W. E. Whybourne, Marksville	10.
Island B	Cowper	Parry Sound	Miss I. M. Campbell, Parry Sound	.50
Island 270	Carling	"	Miss I. M. Campbell, Parry Sound	.5
Wright Island	Finlayson	Nipissing	Unattached	.29
Island opp. Lot 20 in 2	Cavendish	Peterboro.	A. N. Wilson, Kinmount	5.6
Island 782a	Harrison	Parry Sound	Miss I. M. Campbell, Parry Sound	5.45
Island, Parcel of 11a	"	"	Miss I. M. Campbell, Parry Sound	6.
Island B 474	Cowper	"	Miss I. M. Campbell, Parry Sound	1.1
Hawk Island	Chandos	Peterboro.	Wm. Hales, Apsley	.23
Big Island	"	"	" "	.37
B 485	Cowper	Parry Sound	Miss I. M. Campbell, Parry Sound	3.1
Pt. of 26a	Harrison	"	Miss I. M. Campbell, Parry Sound	6.
Parcel 5 of Isld. A	"	"	Miss I. M. Campbell, Parry Sound	21.
Island in Lake	Minden	Haliburton.	R. H. Baker, Minden	7.4
Island 22 in Eagle Lake	Langton	Kenora	J. E. Gibson, Kenora	3.1
Island B	Merritt	Sudbury	E. Arthurs, Espanola	7.
Island opp. Lot 1 in 12, Medora	Freeman and Medora	Muskoka	J. B. Brown, Bracebridge	.66
Island A	Merritt	Sudbury	E. Arthurs, Espanola	1.
Island 347a	Harrison	Parry Sound	Miss I. M. Campbell, Parry Sound	20.
Island 34a	"	"	Miss I. M. Campbell, Parry Sound	.62
Island W.S. 86	Pickerel River	"	Miss I. M. Campbell, Parry Sound	3.66
Island W.D. in McLeod's Bay	Springer	Nipissing	J. A. Philion, Sturgeon Falls	.5
				154.92

W. R. LEDGER,
Free Grants Clerk.
SELBY DRAPER,
Chief Clerk.

W. C. CAIN,
Deputy Minister.

Appendix No. 14.

Statement showing the number of purchasers, acres sold, sales cancelled, acres resumed, patents issued, and acres patented in Townships other than Free Grant during the year ending 31st October, 1921.

Township	District or County.	Agent.	No. of acres sold.	No. of purchasers.	No. of sales cancelled.	No. of acres resumed.	No. of patents issued.	No. of acres patented.
Machin	Temiskaming	S. J. Dempsey, Cochrane	6,014	43	1	150		
Blount	"	"	402	3	4	553		
Shackleton	"	"	7,854	55	3	478.		
Brower	"	"	1,084.50	7	18	2,822.		
Pyne	"	"	1,456.	9	3	481.50		
Newmarket	"	"	3,039	19	7	1,053.50	1	157.
Fauquier	"	"	2,864.	20	5	700.	3	319.
Fox	"	"	4,872.	31	11	1,765.		
Clute	"	"	2,664.	18	20	2,996	7	1,049
Kennedy	"	"	1,182.	8	12	1,790.		
Calder	"	"	4,935	33	11	1,633.	1	150.
Glackmeyer	"	"	846.	6	16	2,402.	4	439
Fournier	"	"	1,075.50	7	8	1,229.50	1	148.
Leitch	"	"	1,589.	11	5	744.	3	111.
Colquhoun	"	"						
Lamarche	"	"	481.	3	8	1,286.50	4	641
Bayley	Temiskaming	Jos. Woollings, Englehart						
Blain	"	"	162.50	1				
Catharine	"	"			2	320.	4	398.50
Chamberlain	"	"			1	160.	1	93.
Dack	"	"	159.	1			3	369.
Davidson	"	"						
Eby	"	"	164.04	2			6	164.50
Evanturel	"	"			1	160.	2	318.50
Gross	"	"	446.50	3	1	127.50	2	74.50
Lagram	"	"	160.	1	3	481.	1	161.
Marter	"	"	160.	1	4	641.50	2	319.50
Marquis	"	"	629.	4	2	318.50	2	319.
Otto	"	"	318.50	2	1	155.	1	40.
Pacaud	"	"	160.	1	4	640.	3	381.75
Pense	"	"	159.	1	2	318.		
Robillard	"	"	160.	1	2	320.	4	640.
Savard	"	"	320.50	2	7	1,120.50	3	479.
Sharpe	"	"	128.	1	1	128.	2	261.
Truax	"	"	158.50	1				
Smyth	Temiskaming	Mark Morgan, Elk Lake						
Lorrain	Temiskaming	Neil J. McAulay, Haileybury	160	1			6	713.
Beatty	Temiskaming	J. E. Mills, Matheson	160	1	2	321	2	324.50
Benoit	"	"	1,125	7	8	1,175.25	10	482.
Bond	"	"	1,443	10	8	1,259	1	154.
Bowman	"	"	154	1	1	154	1	159.50
Calvert	"	"	318	2	2	319	3	357.25
Carr	"	"					4	632
Clergue	"	"	642	4	4	640		
Currie	"	"	796.50	5	8	1,282		
Dundonald	"	"	1,187	7	6	823		

Appendix No. 14—Continued

Township.	District or County.	Agent.	No. of acres sold.	No. of purchasers.	No. of sales cancelled.	No. of acres resumed.	No. of patents issued.	No. of acres patented.
Evelyn	Temiskaming	J. E. Mills, Matheson					1	136.
German	"	"	1,025.	7	4	797.50	3	476.
Hislop	"	"	1,440.50	9	11	1,760.	2	172.
Matheson	"	"	1,119.	8	8	1,240.	1	.88
Mountjoy	"	"	793.	5	5	798.	1	160.
McCart	"	"	794.50	5	1	159.50	5	550
Playfair	"	"	789.	5	11	1,741.50		
Stock	"	"	647.50	4	4	646.	5	800.72
Taylor	"	"	137.	1	1	137.	1	156.
Walker								
Armstrong	"	J. W. Bolger, New Liskeard	80.	1			4	640.50
Auld	"	"			2	315.50	3	79.75
Beauchamp	"	"	317.	2	2	319.	1	160.
Brethour	"	"	261.50	2	3	480.50	3	440.50
Bryce	"	"	479.	3	3	479.50	1	160.
Bucke	"	"						
Cane	"	"	154.	1	2	326.	7	639.50
Casey	"	"					5	735.75
Dymond	"	"					1	80.
Firstbrook	"	"	162.50	1	3	475.50	2	322.
Harley	"	"					5	590.
Harris	"	"					3	243.
Henwood	"	"			1	162.50	2	316.50
Hilliard	"	"	323.	2			5	715.50
Hudson	"	"	293.	2	4	530.	1	162.50
Kerns	"	"					2	380.
Lundy	"	"			1	160.		
Tudhope	"	"			2	322.	4	155.
Casgrain	Algoma	J. L. O'Donnell, Hearst	3,850.	26	17	2,606.	1	151.
Eilber	"	"	5,507.	36	12	1,787.		
Hanlan	"	"	8,981.	60	30	4,499.	1	167.
Kendall	"	"	8,654.	58	26	3,842.	2	232.
Lowther	"	"	10,084.	68	19	2,791.		
Forbes	Thunder Bay	J. A. Oliver, (acting) Port Arthur.	1,455.50	9	3	508.	2	264.
Lyon	"	"	426.	3	1	161.	4	580.30
Nepigon	"	"	160.	1			3	459.78
Mason	Nipissing	J. A. Philion, Sturgeon Falls					3	315.90
Scollard	"	"	83.	1			2	2.44
Hugel	Nipissing	John Brown, Markstay	320.	2			3	335.25
Widdifield	Nipissing	W. J. Parsons, North Bay	1,282.	8	7	1,119.50	8	754.
Badgerow	Nipissing	Unattached	326.	2			4	594.
Crerar	"	"	469.	3			3	466.50
Falconer	"	"					1	169.
Field	"	"	160.50	1			2	135.
Gibbons	"	"					7	866.50
Loudon	"	"	161.50	1			1	161.50

Appendix No. 14—Continued

Township	District or County	Agent	No. of acres sold	No. of purchasers	No. of sales cancelled	No. of acres resumed	No. of patents issued	No. of acres patented
Awrey	Sudbury	R. A. Teasdale, Massey	160.	1				
Hallam	"	"	124.50	1			1	170.50
Harrow	"	"	421.	3			1	137.
May	"	"	459.50	3			2	238.50
Salter	"	"						
Shedden	"	"					1	160.
Victoria	"	"						
Dowling	Sudbury	J. K. McLennan Sudbury	167.50	1			1	138.21
McKim	"	"	160.	1			3	129.23
Loughrin	"	"	177.	1				
Cody	Temiskaming	Unattached	159.50	1			4	2.70
Maisonville	"	"					19	720.50
Owens	"	"	100.	1				
O'Brien	"	"	1,592.	17	2	213.		
Gough	Sudbury	Unattached	85.50	2				
Bigwood	"	"	803.	5				
Burwash	"	"						
Creighton	"	"					5	199
Delamere	"	"						
Dennison	"	"						
Drury	"	"						
Dryden	"	"						
Falconbridge	"	"						
Lolevet	"	"					2	409.23
Graham	"	"	.70	1			2	1.06
Louie	"	"	315.50	2			2	80.84
Louise	"	"	364.	3			5	523
McKinnon	"	"						
MacLennan	"	"					2	42.20
Shakespeare	"	"	244.	2			2	61.50
Snider	"	"					2	10.74
Waters	"	"	177.	1			2	120
Drayton	Kenora	S. H. Holland, Kenora	144	1				
Dunnet	Peterborough	Unattached			1	100.		
Bright	Algoma	Thos. Dodds, Thessalon	160	1				
Bright Ad.	"	"						
Dry	"	"						
Gladstone	"	"					4	501
Gould	"	"						
Haughton	"	"						
Johnson	"	"	160.50	1			2	40
Kirkwood	"	"						
Parkinson	"	"	80.	1	1	160	2	318.50
Patton	"	"			1	157.50	1	158
Rose	"	"					1	160
Striker	"	"			1	160		
Thompson	"	"						
Wells	"	"						
Aweres	Algoma	Thos. Dean, Sault Ste Marie					1	153.

Appendix No. 14—Continued

Township	District or County	Agent	No. of acres sold	No. of purchasers	No. of sales cancelled	No. of acres resumed	No. of patents issued	No. of acres patented
Tarentorus	"	Thos. Dean					1	160.
Vankoughnet	"	Sault St. Marie	302.	2				
Jaffray	Kenora	Unattached					1	60.50
Malachi	"	"						
Umbach	"	"	160.	1				
Matchedash	Simcoe	Unattached	14.	2	1	60.	5	33.84
Rama	Ontario	Unattached	50.	1			1	50.
Carden	Victoria	Unattached						
Digby	"	"	104.	1				
Laxton	"	"						
Somerville	"	"	167.	2	1	159.	1	100.
Ashby	Lennox and Addington	Unattached	100.	1			4	222.
Denbigh	"	"						
Sheffield	"	"					3	482.50
Admaston	Renfrew	Unattached	200.	2			4	400.
Bagot	"	"	285.	2	1	100.	2	200.
Blithfield	"	"					3	363.
Bromley	"	"			1	100.	4	295.
Horton	"	"					2	202.
McNabb	"	"			1	100.	1	100.
Westmeath	"	"					1	80.
Tudor	Hastings	Unattached			1	99.		
Beckwith	Lanark	Unattached						
Dalhousie	"	"	100.	1			2	290.
Darling	"	"					2	130.
Pakenham	"	"						
Lanark	"	"						
Sherbrooke N.	"	"						
Malden	Essex, S.	Unattached	13.42	1	1	6.	1	14.55
			107,914.03	736	398	60,525.25	307	31,390.87

Appendix No. 14—Concluded.

Statement showing the number of purchasers, acres sold and of patents issued in Townsites during the year ending 31st October, 1921.

Townsite.	District or County.	Agent.	No. of acres sold.	No. of purchasers.	No. of patents issued.	No. of acres patented.
Capreol	Sudbury	Unattached	2.20	16	2	.27
Gogama	"	"	1.27	12		
Frederickhouse	"	"	.10	1	3	21
Alexander	Temiskaming	Unattached	1.50	5	2	.50
Kirkland Lake	"	"	1.10	11	5	.33
Hearst	Algoma	Unattached	6.25	25	3	.75
Missinabie	"	"	3.57	20		
Macfarlane	Kenora	Unattached	.76	2	2	.93
Minaki	"	"	.23	1		
Petawawa	Renfrew	Unattached	11.03	1	3	22.40
Trenton	Hastings	Unattached	.66	1	1	.66
Shrewsbury	Kent	Unattached	20.	1	3	22
Grant	Thunder Bay	Unattached	1.02	6	6	1.20
			49.69	120	30	49.25

ISLANDS SOLD.

Cody	Temiskaming	Unattached				
H 2 in Night Hawk Lake	"	"	.10	1	1	.10
H 3 " " "	"	"	.10	1	1	.10
H16 " " "	"	"	1.50	1	2	2.50
X South Crosby	Leeds	"	.05	1	2	.85
Allen Island (42)	Sudbury	"	31.50	1	1	31.50
		Total	33.5	5	7	33¼

Number of lots assigned..... 314 Number of acres assigned..... 44,637

SELBY DRAPER, Chief Clerk.
J. E. DRINKWATER, Clerk of Sales.

W. C. CAIN,
Deputy Minister.

Appendix No. 15.

Honourable Beniah Bowman,
Minister of Lands and Forests,

Report on Crown Surveys.

Sir,—The nature and extent of the surveys carried on during the past year under instructions from this Department may be briefly described as follows:

Base and Meridian Lines.

Phillips and Benner, Ontario Land Surveyors, of Port Arthur, and K. G. Ross, Ontario Land Surveyor, of Sault Ste. Marie, were charged with the running of certain base and meridian lines in the territory lying west of the Nepigon Forest Reserve, District of Thunder Bay. The extent of this work is approximately 200 miles, and the reports will disclose the physical features of the large unexplored area to the east of the Lake Superior Branch and south of the Transcontinental line of the Canadian National Railway. A meridian line is run through this territory along or near to the divide between Lake Nepigon and Sturgeon Lake waters and intersects the Canadian National Railway near Allanwater.

Ontario Land Surveyors Sutcliffe and Neelands were instructed to perform a survey of a similar nature in the District of Timiskaming lying between the Abitibi and Mattagami Rivers and north of Niven's base line, in latitude 49 degrees, 35 minutes, 30 seconds north. The extent of this work was over 100 miles, and within this area is included the Great Falls on both rivers mentioned. Owing to the early extension of the Temiskaming and Northern Ontario Railway north from Cochrane, the blocking out of this area will be of great advantage in locating the railway line, also timber and land areas therein.

Township Boundaries.

The blocking out of townships was continued in the Districts of Sudbury and Algoma in the country lying between the Canadian Pacific Railway and the Canadian Northern line of the Canadian National Railways, the extent of lines being approximately 525 miles.

H. J. Beatty, Ontario Land Surveyor, established the boundaries of several nine-mile townships in the country east of the Algoma Central and Hudson Bay Railway and north of Missinaibi Lake, in the District of Algoma.

J. W. Fitzgerald, Ontario Land Surveyor, and Speight & Van Nostrand, Ontario Land Surveyors, completed the blocking out of the six-mile townships in the north-west part of the District of Sudbury.

C. V. Gallagher, Ontario Land Surveyor, and McAuslan and Anderson, Ontario Land Surveyors, were engaged in similar work north of the Canadian Pacific Railway between Spanish Forks and Woman River Stations.

Interprovincial Boundary Between Ontario and Manitoba.

Owing to the prospecting and mining activity in the district north of the Winnipeg River, in the Province of Manitoba, and that mining claims might be staked over the interprovincial boundary line at any time, in order to prevent

possible complications it seemed advisable to provide for an early defining of the said line north from where it was terminated by the survey in 1898 at the Winnipeg River.

An Act of Parliament of Canada assented to 1st April, 1912, describes the first stretch of this interprovincial boundary as follows:

> "Commencing at the most northerly point of the westerly boundary of the Province of Ontario as determined by "The Canada (Ontario Boundary) Act 1889; thence due north along the same meridian to the intersection thereof with the centre of the road allowance on the 12th base line of the system of Dominion Land Surveys."

An Order in Council approved by His Honour the Lieutenant-Governor dated 9th day of February, 1921, appointed the Director of Surveys Interprovincial Boundary Commissioner for the Province of Ontario. An order in council approved by His Excellency the Governor-General dated 26th day of February, 1921, appointed the Surveyor General Interprovincial Boundary Commissioner for the Dominion. These Orders in Council authorized the said Commissioners to take the necessary steps for proceeding with the survey.

J. W. Pierce, Ontario and Dominion Land Surveyor, of Ottawa, was instructed to take charge of the field operations and actual survey work on the ground commenced about 1st June, 1921, and continued until the middle of October.

The character of the work may best be understood by quoting some extracts from Surveyor Pierce's interim report, as follows:

> "About 70 miles of line was opened out, along which 52 monuments were erected. Of these, 11 were concrete monuments, while the rest were rock bolts cemented in holes in the rock alongside of a rock pyramid 5 feet square at the base and 3 feet high. These pyramids were solidly built of suitable stone, which was roughly hewn so that they present a finished appearance. The line itself was so opened that it has a 12 foot clear sky line, and its centre on the ground was cleared as far as possible of all obstructions to careful chaining.
>
> "The main chainage was obtained by suspending a chain between two tripods on one of which a transit was mounted for purposes of alignment and measurement of slope. A uniform tension was obtained by the use of a spring balance while temperature corrections were applied throughout. The chain used in the field was obtained at intervals with a standard which had previously been tested here in Ottawa.
>
> "A further chainage, independent of this semi-precise method, was carried on by the use of a 300 foot chain, chainage pins, plumbobs and clinometers as a check, for the purpose of detecting errors. Distances across water were obtained by the mean of two independent triangles with apex angles of 30 degrees. After the first couple of weeks, the entire chainage, both main and check, was carried on by two chainmen, one of whom was a Land Surveyor.
>
> "In addition to the topography obtained along the line, traverses were made as far as possible, of all the lakes that could be found within a mile of the line. That part of the work is shown on the accompanying plots and will be greatly extended by the addition of the information obtained by the geologists.
>
> "The line passed through a well wooded country, which, except through a part south of Snowshoe Lake, has not been touched by fire. Some timber

of commercial value was encountered, although the greater portion is not large enough for that purpose. Jackpine, of course, predominates. The surface is extremely rough and irregular, with a prevailing direction of ridge and valley nearly at right angles to the line. Except in the vicinity of the mining district, there has been no summer travel here for years, so that our transportation problem was one of the most difficult of our operations. As we had little advance knowledge of the district, I endeavored to make use of Indian guides, but with only indifferent success, as these had a knowledge limited to an area they had hunted through. When once past that area, they were useless in locating new routes. We found that we had to depend on ourselves to hunt up the water areas and open out portages for the use of the transport. On account of not getting our caches properly distributed last spring, this required a great deal of labour during the summer, which at times interfered with the progress of the line clearing. Much of this may be avoided next season by having the caches placed earlier in the winter and I am hoping that this may be attended to during January and February."

Lake and River Traverse.

The traverse surveys performed by the several survey parties were as follows:

(1) Continuation of traverse of islands and shores of Lake St. Joseph, together with certain township lines adjoining in the District of Thunder Bay, by James S. Dobie, Ontario Land Surveyor.

(2) Traverse of islands and shores of French and Pickerel Rivers extending from the Canadian Pacific Railway crossing to Georgian Bay, by T. J. Patten, Ontario Land Surveyor.

(3) Continuation of traverse of Missinaibi River, by C. R. Kenny, Ontario Land Surveyor.

(4) Traverse of Kenogami River, District of Thunder Bay, by R. S. Kirkup, Ontario Land Surveyor.

(5) Survey of islands at the southern end of Lake of the Woods, by D. J. Gillon, Ontario Land Surveyor.

(6) Traverse of lakes in the Timagami Forest Reserve, districts of Timiskaming and Nipissing, by T. G. Code, Ontario Land Surveyor.

(7) Traverse of certain lakes and rivers in the townships of Wallbridge and Harrison, District of Parry Sound, by J. T. Coltham, Ontario Land Surveyor.

Timber Limit Surveys.

The centre lines dividing into east and west halves Townships Nos. 41 and 44 along the line of the Canadian Pacific Railway, in the District of Sudbury, were run under instructions from this Department by Lincoln Mooney, Ontario Land Surveyor, for the purpose of defining certain timber areas.

Timber areas in the District of Kenora, south of the Canadian Pacific Railway, near Ignace, were defined by Phillips and Benner, Ontario Land Surveyors.

A timber line was also run in the township of Penhorwood, in the District of Sudbury, by Lincoln Mooney, Ontario Land Surveyor.

Miscellaneous Surveys.

(1) The subdivision of part of the Town Site of Kapuskasing was completed by G. F. Summers, Ontario Land Surveyor. The subdivided area comprises 850 town lots with streets, boulevards and park areas.

(2) An addition to the Town Site of Hearst, consisting of blocks lettered A to U, including an extension of the several streets; this area lies south of the already subdivided portion and north of the Mattawishquia River. Survey performed by John Lanning, Ontario Land Surveyor.

(3) Resurvey of certain lines in the northern part of the township of Pardee was made as directed by Ontario Land Surveyors Bingham and Kirkup.

(4) R. M. Anderson, Ontario Land Surveyor, was instructed to establish the boundaries of Long Point Park on Lake Erie, having due regard to lands already granted by letters patent.

(5) C. E. Fitton, Ontario Land Surveyor, was instructed to make a survey of certain park lots on lots 28 and 29, concession 8, township of Wood, and prepare plan for registration.

(6) Sutcliffe and Neelands, Ontario Land Surveyors, made a survey of the line between lots 11 and 12, concession 4, township of Firstbrook, District of Timiskaming.

Inspection.

The reports by Inspector C. E. Fitton on the field work show that with one or two exceptions, the work has been well and carefully performed, and it is satisfactory to know that the placing of standard iron posts and construction of mounds and pits have received proper attention.

Detailed reports of the several surveys for which returns have been made during the year will be found in Appendices 15A to 40 inclusive.

L. V. Rorke,
Director of Surveys.

Toronto, October 31st, 1921.

Appendix No. 15-a.

Statement of Municipal Surveys confirmed during the twelve months ending October 31st., 1921.

No.	Name of Surveyor.	No.	Date of Instructions.	Description of Survey.	Date when confirmed under R. S. O. 1914, Chapter 156, Secs. 10-15, inclusive.
1	James J. MacKay.	723	April 9, 1920.	To survey the original road allowance between the 2nd and 3rd concessions of the Township of Beverley, extending from the westerly side of lot No. 31 to the easterly side of lot No. 36, and to plant stone or other durable monuments to mark the said road allowance.....	Nov. 2,1920.
2	Edward J. Raimboth.....	724	Aug. 17, 1920	To survey the concession road allowance between the 4th and 5th concessions, Ottawa front, lying between the westerly side of the side road between lots 5 and 6 and the easterly side of the side road between lots 15 and 16 on said concession road allowance, in the Township of Gloucester, and that stone or other durable monuments be placed to mark the boundary of the said road allowance.	Jan. 27, 1921.

L. V. RORKE,
Director of Surveys.

W. C. CAIN,
Deputy Minister Lands and Forests.

Appendix No. 16.

Statement of Municipal Surveys for which instructions issued during the twelve months ending October 31st, 1921.

No.	Name of Surveyor.	No.	Date of Instructions.	Description of Survey.
1	Speight and vanNostrand..	726	Aug. 18, 1921	To survey the limits of Durie Street in the City of Toronto, in the County of York, and to plant stone or other durable monuments to define the limits of said street.
2	F. F. Miller.	727	April 12, 1921	To survey the road allowance along the 8th and 9th concessions of the Township of Hinchinbrooke from the south boundary of said Township northerly to lot No. 3, and that stone or other durable monuments be placed to mark the said road allowance.
3	J. J. Newman..	728	May 5, 1921	To survey and mark with permanent monuments the limits of the Tecumseh Road in the County of Essex, as follows: (a) The original road allowance along the front of lots adjoining Lake St. Clair in the Township of Maidstone extending from the BelleRiver westerly to where the said Tecumseh Road leaves the allowance for road laid out in the original survey of the said Township and is not intended to follow the same. (b) Survey of the original road allowance between concessions 1 and 2 from the westerly limit of Township lot 129 to the easterly limit of the Town of Walkerville in the Township of Sandwich East. (c) Survey of the original road allowance across the Township of Anderdon through and in front of lots fronting on the Detroit River.

L. V. RORKE,
Director of Surveys.

W. C. CAIN,
Deputy Minister Lands and Forests.

Appendix No. 17.

Statement of Crown Surveys in progress during the twelve months ending October 31st, 1921.

No.	Date of Instructions.	Name of Surveyor.	Description of Surveys.	Amount paid.
				$ c
1	Oct. 3, 1921.	R. M. Anderson..	Retracing and establishing the boundaries of land lying between Long Point and Walsingham Township.....	200 00
2	April 15, 1921.	H. J. Beatty.....	Survey certain township outlines in the District of Algoma.....	7,650.00
3	May 16, 1921.	Jas. T. Coltham....	To traverse certain Lakes and Rivers in the Township of Wallbridge and Harrison.....	2,100.00
4	May 2, 1921.	T. G. Code.....	Traverse certain Lakes and Streams in The Timagami Forest Reserve, District of Timiskaming and Nipissing...	4,950.00
5	April 15, 1921.	James S. Dobie....	Traverse the Islands and shores of Lake St. Joseph and run certain Base and Meridian Lines in Thunder Bay District.....	7,650.00
6	May 17, 1921.	C. E. Fitton.....	Inspection of Surveys, 1921.....	2,700.00
7	April 15, 1921.	J. W. Fitzgerald....	Survey certain Township Outlines north of C. P. R. in Districts of Sudbury and Algoma.....	7,290.00
8	May 18, 1921.	D. J. Gillon.....	Survey Islands and shore lines in part of Lake of the Woods, in the Districts of Rainy River and Kenora.....	4,800.00
9	May 5, 1921.	Chas. V. Gallagher .	Survey certain Township Outlines north of the C. P. R. in the District of Sudbury.....	5,250.00
10	May 2, 1921.	Roy S. Kirkup.....	Traverse the Kenogami River and its expansions in the Districts of Thunder Bay and Algoma.....	2,550.00
11	April 22, 1921.	Carmen R. Kenny..	To continue traverse of Missinaibi River in Districts of Algoma and Timiskaming.....	3,800.00
12	Oct. 3, 1921.	L. Mooney.....	Survey a Meridian, Township 44, along C. P. R., District of Sudbury.....	300.00
13	May 6, 1921.	McAuslan and Anderson.....	Survey certain Township Outlines north of C. P. R., District of Sudbury.....	5,900.00
14	May 16, 1921.	T. J. Patten.....	Survey Traverse Islands in French River, Districts of Parry Sound and Sudbury	3,100.00
15	April 15 ,1921.	Phillips and Benner.	Survey certain Base and Meridian Lines in District of Thunder Bay.....	7,470.00
16	Aug. 22, 1921.	Phillips and Benner.	Survey Outlines Timber Berth south of Ignace, District of Kenora.....	1,000.00
17	Mar. 7, 1921.	J. W. Pierce.....	Survey of portion of Interprovincial Boundary between Ontario and Manitoba.....	12,500.00

Appendix No. 17.—Concluded.

Statement of Crown Surveys in progress during the twelve months ending October 31st, 1921.

No.	Date of Instructions.	Name of Surveyor.	Description of Surveys.	Amount paid.
18	April 15, 1921.	K. G. Ross.....	Survey of Base and Meridian Line, District of Thunder Bay.....	6,800.00
19	April 15, 1921.	Speight and Van Nostrand.....	Survey certain Township Outlines at head waters of Missinabie River, Districts of Sudbury and Algoma.....	8,415.00
20	Nov. 4, 1920.	Bingham and Kirkup.....	Re-survey certain lines in Township of Pardee, District of Thunder Bay....	3,450.00
21	May 27, 1920.	G. F. Summers.....	To survey a townplot and other lands in the vicinity of Kapuskasing, Township of O'Brien, District of Timiskaming..	3,550.00
				$101,425.00

L. V. RORKE,
Director of Surveys.

W. C. CAIN,
Deputy Minister of Lands and Forests.

Appendix No. 18.

Statement of Crown Surveys completed and closed during the twelve months ending October 31st, 1921.

No.	Date of Instructions.	Name of Surveyor.	Description of Survey.	Amount paid.
				$ c.
1	May 11, 1920.	Chas. V. Gallagher.	To survey certain Township Outlines north of C. P. R., District of Sudbury.	5,916.79
2	May 12, 1920.	M. E. Crouch.....	To survey certain Township Outlines north of C. P. R., District of Thunder Bay.....	1,760.90
3	May 18, 1920.	Phillips and Benner.	To survey Meridian Lines forming west boundary of the Nepigon Forest Reserve, District of Thunder Bay.....	2,158.75
4	May 21, 1920.	Speight and Van Nostrand.....	To survey certain Township Outlines north of C. P. R., District of Sudbury	2,003.92
5	May 21, 1920.	J. W. Fitzgerald....	To survey certain Township Outlines north of C. P. R., District of Sudbury.	1,921,78.
6	May 12, 1920.	H. J. Beatty.....	To survey certain Township Outlines, District of Sudbury.....	1,967.53
7	May 4, 1920.	C. R. Kenny.....	To continue traverse of Missinabi Lake and River, Districts of Algoma and Sudbury.....	1,869.55
8	May 4, 1920.	T. J. Patten.....	To traverse Lake Penage Islands and other lakes and outlets in District of Sudbury.....	2,484.93
9	Aug. 24, 1920.	Sutcliffe and Neelands.....	To traverse part of the Montreal River, District of Timiskaming.....	2,147.80
10	May 17, 1920.	K. G. Ross.....	To survey a Meridian and Base Line in in the District of Patricia.....	4,215.75
11	May 4, 1920.	T. G. Code.....	To continue traverse of certain Lakes and Rivers, Districts of Sudbury and Timiskaming.....	2,250.84
12	May 5, 1920.	Bingham and Kirkup.....	Traverse certain Lakes and Rivers, District of Algoma.....	2,159.63
13	May 15, 1920.	J. S. Dobie.....	To traverse the shores of Lake St. Joseph and run certain Base and Meridian Lines in the District of Patricia.....	2,872.82
14	May 12, 1920.	A. C. Young.....	To survey certain Township Outlines north of C. P. R. District of Sudbury.	1,895.15
15	May 11, 1920.	McAuslan and Anderson.....	To survey certain Township Outlines north of C. P. R., District of Sudbury.	1,359.38
16	May 27, 1921.	John Lanning.....	Survey additional Townplot Hearst.....	867.80
17	May 6, 1921.	Sutcliffe and Neelands.....	Survey certain Meridian and Base Lines, District of Timiskaming.....	10,076.30

Appendix No. 18.—Concluded.

Statement of Crown Surveys completed and closed during the twelve months ending October 31st, 1921.

No.	Date of Instructions.	Name of Surveyor.	Description of Survey.	Amount paid
18	Aug. 24, 1921.	L. Mooney	Survey Meridian Line in Township No. 41 along C. P. R., District of Sudbury.	602.80
19	Nov. 14, 1920.	C. E. Fitton	Inspection of Surveys for 1920	2,003.71
20	Feb. 28, 1920.	J. S. Dobie	To survey Kaskaweogama Lake and Island Lake	1,072.75
21	May 1, 1919.	G. L. Ramsay	To survey Base and Meridian Lines, District of Thunder Bay	2,056.50
22	Dec. 16, 1920.	Sutcliffe and Neelands	Survey in Township of Firstbrook between lots 11 and 12 in the 4th concession	41.25
23	Dec. 16, 1920.	L. Mooney	To run a line in Township of Penhorwood, District of Sudbury	1,184.10
24		C. E. Fitton	Survey of lots 28 and 29, concession 8, Township of Wood	446.10
25			Reid and Brown—Surveyors' Posts	908.16
				$56,244.99

L. V. RORKE,
Director of Surveys.

W. C. CAIN,
Deputy Minister Lands and Forests.

Appendix No. 19.

Sault Ste. Marie, Ont., October 31st, 1920.

Sir,—I beg herewith to submit the following report of the survey of a meridian line and a base line run during the summer of 1920 under instructions from the Department of Lands and Forests, dated May 17th, 1920.

I left Franz Station on the Canadian Pacific Railway on May 28th, 1920, with a party of twenty men, and travelled to Hudson Station by way of the Algoma Central & Hudson Bay, and Canadian National Railways. We were obliged to wait over for one day in Hearst. Hudson Station is situated on an arm of Lac Seul called Lost Lake, and consists of a small Hudson Bay Post. I was met by the Transportation Agent of the Company for that district and received the courteous assistance for which the Company is noted. We detrained at 11 o'clock in the morning of May 28th, and left the next morning at 7.30 o'clock in a York boat towed by the Hudson Bay Company freighting launch, "Ripple." We camped over night at Lac Seul Post and arrived at our point of commencement the next day at noon. My supplies had previously been taken to Pine Ridge Post 20 miles farther down the lake. The men for the freighting canoes went on to this post. The next morning the Ripple brought us back enough provisions for two weeks. We commenced work on the 30th of May and finished the 6th of September, having run 160 miles of line.

Our place of beginning was the 33rd mile post of O. L. S. Patten's meridian line of 1919, which was run north astronomically from the north-west corner of the township of Rowell. This point is on the north shore of Lac Seul. From there we ran north astronomically 87 miles to the 120th mile post of the said meridian. We then ran west astronomically 73 miles on 6 mile chords of the parallel of latitude. The first twenty miles of our meridian, namely, as far as Wenassagay River, was through green timber, the remaining 67 miles was almost entirely through a brule from eight to ten years old where fallen timber was piled three to six feet high. Our base line was also through brule for its whole length.

The freighting canoes went first up the Wenassagay River to Bluffy Lake and left a cache on an island there. They then returned to Pine Ridge Post and started out with the bulk of the supplies to Goose Lake by way of the English River, Trout Lake River, Woman River, Shabumeni (Gooseberry) Lake and Berens River. We first met them a few miles below Woman Lake. From this point to Goose Lake they brought supplies in to us from their main canoe route approximately every fifteen miles until we reached Goose Lake. From Goose Lake to Pekangekum (Dirty Water Narrows) I was able to provision the party every four or five days as the Berens River paralleled the line through this distance. The general direction of the Berens River below Pekangekum is northwesterly, and I anticipated difficulties in keeping touch with the freighting canoes. The Indian Chief came to my rescue at the last moment and acted as guide, with the result that I was able to get all my canoes to a point on the line eight miles from the end.

The party consisted of twenty-five in all, made up as follows:

1 Surveyor,
1 Assistant,
2 Chainmen,
1 Cook,

7 Axemen,
7 Packers on line,
6 Packers with Canoes.

This distribution varied considerably as the work progressed. Three of these men were Indians from Pine Ridge Post, and left me at Goose Lake. In going out they took two canoes and some provisions to cache for me at Pekangekum. I took on two new men at this point. From Goose Lake onwards I kept only three men with the canoes. In fact, after the first twenty miles of my work, I managed to keep at least seven men chopping on the line.

I feel that I should mention the splendid quality of the provisions which I obtained from the Wholesale Department of the Hudson Bay Company at Winnipeg, and the excellent way in which they were packed for survey work. We did not lose an ounce of provisions from any cause during the whole course of the survey.

The Indians in the Pekangekum Indian Reserve were very much disturbed by the fact that the line was heading for their lands and protested vehemently. Their Chief, in company with all the older men of the tribe, met us ten miles east of the Reserve and stayed with the party until we reached their property. We struck the southern end of it so I agreed to offset the line to avoid it. The Chief of the Tribe then acted as guide for our freighting canoes to the end of the work and sent two Indians to guide us out to Lac Seul, a trip of nine days. This was a very great help as the line was not near any main waterway and the country totally unmapped. This band of Indians is about four hundred in number and they are very primitive in their mode of living. They trade at a Hudson Bay Outpost managed by an Indian who does not speak a word of English, nor have any of the tribe any knowledge of English. They do not use money at all and gauge time by the height of the sun above the horizon; distance by the progress of the sun during a journey. This made it very difficult to obtain any information sufficiently definite to work on. In all other parts of Ontario known to myself, the Indians refer to the King as "Kitchi Ogemah," The Big Chief. At Pekangekum he is called "Wemitiekiji," The Frenchman. Although they have undoubtedly been visited by missionaries, Christianity has not the slightest foothold among them, and they still hold to their native superstitions and ceremonies, such as "Wabinca," (Day Light Dance), etc. There was no evidence of tuberculosis or other disease among them. In many cases four generations were living in the same camp.

It was my intention to go out by the Berens River to Lake Winnipeg and there to take the Hudson Bay steamer to Selkirk. There is a good waterway from the end of our line to Little Grand Rapids, Hudson Bay Post on the Berens River. My ignorance of the schedule of the steamer and the danger from fifty-five unknown rapids below us on the Berens River influenced me to double back to Pekangekum and strike for Lac Seul from there. The Indian Chief supplied me with two guides to Red Lake where there is an outpost of the Hudson Bay Company, and from there we were able to follow the Dominion Government Geological map to our first destination at Hudson. I was five days in getting to my work and twelve days in getting back to Sault Ste. Marie after its completion. The expense in wages, railway fares and board in taking a large party such a distance was great. The Indians of that locality, however, work in the summer only as a pastime and could not be depended on for more than three weeks' steady work, so that this expense was inevitable.

The new system of monumenting each third mile entailed a good deal of extra work, but it is undoubtedly an excellent method of ensuring permanent record of lines in the field. I did not find the new iron posts much more difficult to handle than the old type as we were only supplied with sufficient for ninety miles, but had we taken enough for all our work, it would have necessitated employing another man with the freighting canoes. Fifty per cent. of the iron posts planted were witness posts and many of them a considerable distance

Surveyed line in Patricia.

from the true mile post, due to solid rock, muskeg, etc. We experienced considerable difficulty digging pits in the first few miles owing to frozen ground.

Soil.

The only section which presents any possibilities as farming land is along the Berens River from mile 16 on the base line to mile 45. This is

fairly level land and is of good clay loam, about 250 square miles in extent. Elsewhere there are pockets of arable land but not of sufficient extent to be worthy of note. For the most part it is solid rock and swamp or muskeg. Where there is soil of any kind it is as a rule very light sand. The occasional pockets of clay loam are so thickly sprinkled with boulders as to be of no use. West of Pekangekum the country is consistently solid rock. We ran a line around two sides of a rectangle and travelled the other two by canoe. The freighting canoes went across the south half of this rectangle. From information obtained in this way and from questioning the Indians, I am practically certain that there is no land of farming value in this area except that above mentioned, with the possible exception of a narrow strip on each side of the English River from the junction of Red Lake River to Lac Seul.

Timber.

The area between Wenasagay River and Lac Seul is well timbered with spruce and jack pine, averaging about four cords to the acre each, taking the section as a whole. There is a considerable quantity of balsam here and lesser stands of birch and poplar. The north shore of Lac Seul seems to be the northern limit of white pine, red pine and cedar. There are a few scattered trees of each of these along the lake shore. North of the Wenasagay River and over all of the country included in the rectangle above described, fire has swept about eight or ten years ago. On this huge area a second growth of banksian pine is springing up in most places. Here and there a few square miles of the original stand have escaped the fire, more particularly on the clay belt referred to along the Berens River. In this section there are some small stands of large aspen and spruce, but the quantity is too small to be of commercial value. Previous to these fires the entire country has been very thickly wooded with spruce of commercial size.

Minerals

With the exception of two small areas we encountered only barren laurentian formation. Two miles north of the Wenasagay River we first encountered Huronian schists and greenstones and ran through this for twenty miles. We found nothing of value in place, but found float of mahnetite, pyrites and Galena. On our trip out we again encountered Huronian formation in the neighborhood of Red Lake.

Water Power.

There are no water powers of outstanding value on any of the rivers which we encountered. Those falls which might be mentioned are as follows:

1. Twin Falls, on the Wenasagay River immediately below Bluffy Lake. The upper falls could be flooded out by a dam at the lower one to give a natural head of about 50 feet. This could not be materially increased. The low water flow is about 200 c.f.s. The drainage area is about 5,000 square miles. Storage possibilities as known are poor.

2. Woman Falls, on the Berens River. The natural head is about 15 feet, and could not be increased. Low water is about 250 c.f.s. Drainage area about 600 square miles. Storage possibilities as known are poor.

3. White Dog Falls, on the Berens River. The natural head is about 18 feet. It could be increased to 28 feet. The low water flow is about 250 c.f.s. The drainage area about 600 square miles. Storage possibilities as known are poor.

4. Otter Falls, on the Berens River. The natural head is about 15 feet. It could be increased to 35 feet. Low water is about 350 c.f.s. The drainage area about 900 square miles. Storage possibilities as known are poor.

5. Mickkaiame Falls, on the Berens River. The natural head is about 30 feet. It could not be increased. Low water flow is about 500 c.f.s. Storage possibilities are poor. Drainage area about 1,000 square miles.

6. Big Falls, on Trout Lake River. Natural head, 60 feet. Could be increased to 70 feet. Low water flow 200 c.f.s. The drainage area is about 900 square miles. Good storage in Trout Lake and Woman Lake.

Moose in Patricia Forest.

GAME.

The entire area abounds in moose, red deer and bear. Near Lac Seul and in the neighborhood of the west end of the base line there are large numbers of caribou. The Indians report a few elk. There are wolves everywhere, but

not in great numbers. The devastation by fire has reduced fur-bearing animals to a minimum. The scarcity of beaver is particularly noticeable. Partridge and ducks are plentiful.

FISH.

Pickerel, pike, maskinonge, whitefish and suckers are in abundance in all the lakes. Whitefish are particularly plentiful in the expansions of the Berens River below the Mickkaiame Falls. Sturgeon are also plentiful in these waters. As far as I was able to learn there are neither brook trout or lake trout in the country.

This is my report.

I have the honour to be, Sir,

Your obedient servant,

K. G. Ross,

Ontario Land Surveyor.

The Honourable, the Minister of Lands and Forests,
Toronto, Ontario.

Appendix No. 20.

SURVEY OF BASE AND MERIDIAN LINES IN THE DISTRICT OF THUNDER BAY.

SAULT STE. MARIE, ONT, September 15th, 1921.

SIR,—I beg to submit the following report on the survey of base and meridian lines in the District of Thunder Bay, run by me during the summer of 1921, under instructions from the Department of Lands and Forests dated May 17th, 1921.

I left Sault Ste. Marie by boat on May 27th, with nine Indians from Garden River and was joined by eight Indians from Chapleau at Fort William. We took the C.N. Railway to Quorn Station and were there joined by three local Indians. On May 30th, we commenced cutting line with a party of twenty-four and proceeded with the work without interruption until its completion on July 23rd. During this time we lost eight hours on account of rain.

Our place of beginning was the 72 Mile Post on O.L.S. Niven's meridian line between the districts of Thunder Bay and Kenora. From there we ran our base line east astronomically thirty-six (36) miles, and from this 36 mile post we ran our meridian north astronomically sixty (60) miles and thirty-three (33) chains to its intersection with the main line of the Canadian National Railway about two (2) miles west of Allan Water Station.

Our freighting canoes were unable to provision the party until we had run thirty miles of the base line, but from this point to the end of the work we were in close touch with them all the time, with one exception. On this occasion the party were entirely out of provisions and lived for two days on game. At

the conclusion of the work we stored our canoes with the Hudson Bay Company at Allan Water and entrained for home.

The party consisted of twenty-four in all, made up as follows:

1 Surveyor,
1 Assistant,
3 Chainmen,
1 Cook,
1 Cookee,
6 Axemen,
7 Packers on line,
4 Packers with freighting canoes.

This distribution was maintained throughout the whole course of the survey, except that where possible two or three packers were put on the line to chop.

Soil.

There are no areas in the country traversed by these lines suitable for agriculture. The country is, in the main, solid rock on the surface and such soil as occurs is glacial sand and gravel covered lightly with decayed vegetable matter.

Minerals.

We found no traces of valuable minerals. The formation encountered was laurentian throughout.

Timber.

From our starting point to the twenty-third mile on the base line the country has been burnt of all timber by several fires. No seeding trees have been left alive and it is covered for the most part with scrubby bushes. There is a little small spruce in some of the swamps. From this point to the end of the base line and through the first fifty miles of the meridian, the country is heavily timbered with large spruce, birch and poplar. In my opinion it extends about ten miles on each side of the meridian and forms a very valuable stand.

Water Powers.

Some rapids and falls were encountered by the freighting canoes on the water way known as Allan Water, but they were a long distance from our line and I have no data on them. The flow of water is not great but the storage possibilities are almost limitless and several of these powers might be jointly harnessed and a commercial amount of power thus carried to the railway by a comparatively short transmission line.

Game.

The timbered country abounds in moose and fur-bearing animals. There are also a few red deer and caribou. Beaver are particularly plentiful. Ducks and partridge appeared to be in great numbers everywhere.

FISH.

Pickerel, pike, whitefish, lake trout and suckers are to be found in abundance in all the lakes.

This is my report.

I have the honour to be, Sir,

Your obedient servant.

(Sgd.) K. G. Ross,

Ontario Land Surveyor

The Honourable, the Minister of Lands and Forests,
Toronto, Ontario.

Appendix No. 21.

SURVEY OF BASE AND MERIDIAN LINES IN VICINITY OF ABITIBI AND MATTAGAMI RIVERS, DISTRICT OF TIMISKAMING.

NEW LISKEARD, ONT., August 30th, 1921.

SIR,—Under instructions from the Director of Surveys, dated May 6th, 1921, our Mr. Sutcliffe and party proceeded to Smooth Rock Falls from whence they followed the Mattagami River to where same is crossed by O.L.S. Niven's base line, which was cut out in the year 1900. There was no difficulty finding this line or in reaching the 27 mile post at which our work began.

As instructed we ran a meridian line due north from O. L. S. Niven's 27 mile post for a distance of 54 miles and 12 links to intersect O.L.S. Speight's base line ran in 1911. From the 18 mile post on our meridian line we ran our first base line west 17 miles 73.50 chains to intersect O.L.S. Speight's meridian line, ran 1911, and east 5 miles 69 chains to the Abitibi River. From the 27 mile post we ran our second base line east 6 miles 48 chains to the Abitibi River. From the 36 mile post we ran our third base line west 17 miles 67.05 chains to intersect O.L.S. Speight's meridian line and east 3 miles 25 chains to the Abitibi River. From the 45 mile post we ran our fourth base line east 42.34 chains to the Abitibi River.

No serious obstacles were met with on the journey in or during the work and outside of having two canoes upset we were fortunate in not having any serious accidents to either our men or equipment. As instructed, 9 mile chords were run on the base lines, and in our field notes we have shown the true astronomic bearing for each mile as run on the ground, and while there are very slight differences from the theoretic bearings and distances, we believe that you will be well satisfied with the accuracy of the work, and we are pleased to report close checking when closing in on O.L.S. Speight's work, done in 1911.

Instrument Work.

Light Mountain Gurley and Ainsworth transits were used. Stellar observations were taken as frequently as possible. Our observations were all calculated, and as a check we used curves previously plotted in our office for the proper latitude and longitude of the work. These curves, without calculation, give the bearing of the Pole Star at any time to the nearest minute. Time corrections were frequently made by observation.

Chainage.

400 link chains were used and slope distances taken when necessary and corrected with the use of a clinometer and slope tables. The tapes were properly tested and the chainers were duly sworn.

Posts and Bearing Trees.

The most durable wood obtainable was selected for posts. With only a few exceptions, no great difficulty was experienced in planting the iron posts. When possible, small trees were marked for Bearing trees. The trees were chosen as nearly opposite one another as possible.

Blazing of Lines

One man on the party was made responsible for the blazing of the line and the results obtained were satisfactory.

Timber and Soil.

It will be observed on the maps that the Abitibi and Mattagami Rivers drop several hundred feet in a short distance. The country lying between these rivers drops in much the same manner. This feature naturally affects the timber conditions. Above and below this drop the country is comparatively level. The upper level is a fairly good clay and mostly covered by spruce forest. In places there are areas from which good pulp wood cuts could be taken, and there are other areas on which the timber is yet too small to be of present value. The width of the area over the drop is about 15 miles. The soil here is sandy and the timber, where not touched by fire, though sometimes scattered, is large. The timber in this area consists of spruce, birch, poplar and balsam.

On the lower level the timber is also small, but we believe there are some fairly good pulp wood areas. Most of this part of the country seen by us had just recently been burned, however. We are unable to state definitely as to the exact area burned, but an approximate estimate would be between 30 and 40 square miles. We are informed that the fire commenced about June 25th and it lasted until extinguished by heavy rains on July 20th. The soil on this area is clay, with a tendency to be slightly sandy in spots, but on the whole is good. Along the most northerly portion of our meridian line the ground was very swampy and the timber, which was chiefly tamarac, small.

East of the Mattagami River there appears to be a large area that was burned years ago, which has since grown up with poplar. West of the Mattagami in the vicinity of our first base line the timber is spruce and very good.

Watercourses.

There are no streams of importance between the Abitibi and Mattagami Rivers in this vicinity. There are a few creeks which could be made navigable for canoes but our lines being so far apart we were not able to get much information concerning same. There apparently are very few lakes.

Rock Formation.

It is only along the rivers in vicinity of water falls and across the country where the drop, before referred to, takes place, that there are rock outcroppings. Along our third base line several low rock ridges were crossed and for the most part the formation is granite. Some porphyry dykes were observed. A ridge of gabro and disbase was also crossed in the vicinity of the 11 mile post on the third base line. Quartz veins seemed very numerous in the granite but no mineral was seen.

Agriculture.

This area is within the clay belt so often spoken of. The soil is suitable for agriculture, but not before the country is burned over or the timber growth cleared away. The moss is so heavy in places that the frost remains in the ground nearly all summer. When the moss and vegetable growth are removed we have no doubt that conditions will be just as favorable for agriculture as in the more southerly portion of Timiskaming District.

Animal Life.

We are informed by the Indians and those who have trapped in this area that fur-bearing animals are plentiful. Among the large animals, moose and bears are plentiful. There are also a few red deer but they are not numerous. Fish are plentiful in the large streams, the principal being sturgeon, pickerel and pike.

Accompanying this report are a general plan on mounted paper, a timber plan on tracing linen and field notes of the survey on the usual forms.

I have the honour to be, Sir,

Your obedient servants,

(Sgd.) Sutcliffe & Neelands,
Ontario Land Surveyors.

The Honourable, the Minister of Lands and Forests,
Toronto, Ontario.

Appendix No. 22.

Survey of Township Outlines in the District of Thunder Bay

Sault Ste. Marie, February 6th, 1920.

Sir,—I beg to submit herewith the following report in connection with the survey of certain base and meridian lines made by me in the District of Thunder Bay, under instructions from your Department dated May 1st, 1919

I commenced my survey on May 17th, having left Sault Ste. Marie on Wednesday, May 14th, with my party of thirteen men. I ran west from the 58th mile post of O.L.S. Niven's on the district line between Algoma and Thunder Bay. This starting point was about four and a half miles north of the Canadian Northern Railway. Owing to an error in my instrument the first nineteen miles of this survey were not run astronomically west. The true bearings, however, are shown on the plan and notes, these having been obtained by observations since the survey was completed. I finished my survey on July 19th.

Durable posts were firmly planted and scribed on the south side at every mile of the survey. For each post two bearing trees were carved. At every three miles on the line iron posts were planted similarly carved to the wooden ones. The other conditions laid down in your instructions were carried out in every respect.

Timber.

The country between the district line and the White Otter River is sparsely timbered. Just west of Hillsport on the Canadian Northern Railway we ran through about four miles of brule. West of the White Otter River the country is heavily timbered with spruce, balsam, birch, poplar and scattered plains of jack pine. Spruce is the predominating timber and grows to a considerable size, running as high as two feet in diameter. On some of the ridges there are good growths of poplar and birch. Cedar is found in the swamps and along the banks of the rivers. Just before leaving this district a fire swept through, and no doubt destroyed a quantity of timber. This fire I understand began near the C.P.R. and burned through to the C.N.R., crossing this railroad at White Otter Station.

Soil.

Most of the area passed over is unsuited for agricultural purposes. The soil is a whitish sand loam. The western part of the district traversed by us was quite rough and rolling. The rock outcrops were not numerous. These were gneiss on the eastern part of the base line, but on the meridian line north of the 18 mile post, a few outcrops of diabase were noticed. One of these occurs at Taradale Station on the C.N.R. No mineral was found on this survey.

Game.

Moose are quite plentiful in the district and occasionally a caribou is seen. Beaver, mink and other fur-bearing animals are numerous. Pike and pickerel abound in the lakes and streams.

The average magnetic variation was 3 degrees west of north.

The length of our base line from the district boundary to the Pic River was thirty-nine miles sixty-four chains and forty-five links. Meridian lines were run nine (9) miles north and nine (9) miles south from the 18 mile post and nine (9) miles south from the 36 mile post and eleven (11) miles and twenty-eight (28) chains north from this post to the southerly limit of the Canadian Northern Railway right-of-way, which was according to the instructions issued by the Department.

Herewith I enclose a general plan of survey, timber plan, field notes, etc. All of which is respectfully submitted.

I have the honour to be, Sir,

Your obedient servant,

(Sgd.) G. L. Ramsey,
Ontario Land Surveyor

Appendix No. 23.

Nipigon, Ont., August 1st, 1920.

Sir,—I beg to submit herewith a detailed report on the survey of certain Township Outlines in the District of Thunder Bay, said townships lying north of the Canadian Pacific Railway and adjoining the boundary line between the Districts of Thunder Bay and Algoma, said survey having been performed by me under instructions dated Toronto, May 12th, 1920.

Pursuant to instructions, I commenced my survey at an iron post planted by O.L.S. Stewart on the line between townships 70 and 71, at the north-west angle of township 70, said point being also the north-east angle of township 71, and being 126 chains 47.9 links north of the centre line of the Canadian Pacific Railway. The meridian and base lines were run pursuant to instructions with the exception of the section of the first base line which forms the boundary between the townships of Atikameg and Bryant, which line was run from east to west, due to the position of White Lake (see plan).

The several lines were well cut out and well blazed, one man devoting his entire time to the blazing. All posts, iron and wooden, were correctly marked and planted, and the bearing trees taken wherever possible. Few cairns of stones were planted about posts, as the country was for the most part sandy, and few stones could be found for this purpose. Particular care was given to the correct marking and planting of the iron posts, the digging of pits and making of mounds.

Frequent astronomical observations were taken, the notes of which accompany the field notes. I personally took the notes on the timber and soil, the chainmen doing the actual chaining only. While on the survey I personally covered a considerable area on either side of each surveyed line to ascertain the size and extent of the timber, being particularly impressed with the large areas of spruce and banksian pine in the townships.

I beg to state that your instructions were closely adhered to in every respect. Before taking up in detail the timber, soil, etc., I may advise you that I have been informed by reliable parties that the country to the north and to the west of these townships is well timbered, that the areas of spruce and banksian pine extend in these directions, particularly to the north, and that good water routes exist whereby such timber may be driven and brought out. If it is the intention of the Department to lay out additional townships for the sale of the timber therein, may I suggest that this territory be investigated before doing so?

Timber.

Throughout the six townships excellent spruce was found, running from 4 to 10 inches in diameter. There are large areas that will yield from 25 to 30 cords to the acre. It is impossible to note here the location of these areas; they exist throughout the entire six townships. Reference to the field notes and timber plan will give the locations of the best of this spruce. The townships McGill, Atikameg and Mikano are the best for spruce timber.

Banksian pine is found throughout all six townships in large amounts, excellent tie timber size. The Austin Nicholson Company, of Chapleau, under permit in previous years, has taken tie timber out from the townships of Atikameg, Bryant and Flood, but not to any considerable extent. They have merely touched the fringe of it. They have camps at present on the meridian line between the townships of Bryant and Flood. Last winter through a subcontractor, this Company cut 87,000 ties, but were unable to get their drive out. They are at present erecting a new dam in an endeavor to get their ties out this summer. No attempt has been made to burn or dispose of the slash, and there is grave fire menace through the several townships on this account, especially as there are Indians, trappers and tourists continually passing through and camping in this area. Two rather serious fires were burning in this area during the progress of the survey, fires which I personally investigated and found not to have been started near or caused by my survey camps.

No adequate and complete report is possible on the extent of the banksian pine in these townships without a careful cruise being made. The townships are all exceptionally well timbered with banksian pine running from 6 to 18 inches in diameter. I was particularly impressed with the possibilities for a sawmill to be located near the north-east angle of the township of Bryant. Excellent roads could be made, several are actually in existence out to the Canadian Pacific Railway siding at Bremner. In view of the scarcity of, and high prices for, lumber in this district, I beg to suggest that if these townships are put up for tender, a clause be included compelling the erection and operation of such a mill.

Aside from the spruce and banksian pine, there is very little other timber in the townships. There is some large poplar and a little cedar, but not in amounts to be of commercial value. Very little balsam was found and the birch, although frequently mentioned in my field notes, was in areas small in extent and of little value.

Soil.

The soil throughout the six townships was sandy with occasional rocky areas and frequent small areas of muskeg. The areas near the Shabotik River and in some other places near lakes or rivers were exceptionally good, but these townships cannot be considered as good for agriculture, certainly not for settlement purposes. The value is to be found in the timber and in the timber alone.

Game.

The country is overrun with moose, and in the southerly two townships red deer, partridge were exceptionally plentiful. Pike found in all of the large lakes. Fishing operations under permit are now being carried on in White Lake, the main catch being whitefish.

Roads.

The only roads through the township are tote roads leading from the Canadian Pacific Railway to the several tie camps and connecting the said camps. These roads are shown on the field notes. The entire country is very level, with the exception of the southerly part of the township of Flood. Roads can easily and cheaply be built for logging operations in almost any part of the areas covered by this survey.

Minerals.

There are no minerals at all to be found on this survey. The rock where it was encountered was granite.

Lakes and Rivers.

As shown on the plan, White Lake and its connecting chain of lakes, form a water boundary to the west of the townships of Bryant, Atikameg and McGill. This is a well travelled route, portages being short and well cut out. There are many lakes throughout the township, all of clear, excellent water, with sandy shores. White Lake has rocky shores for the most part. This lake extends to Mobert and the Hudson Bay Company Post at that point on the Canadian Pacific Railway.

The Shabotik River crosses the townships of Shabotik, Mikano and Atikameg in a general south-westerly direction. This is a wide, well-travelled river, although Gum Creek, one of its tributaries, shown to be a well-travelled river on existing maps, is impassable by canoes, being filled with log jams. For the information of cruisers or others wishing to investigate these townships, I would suggest starting from Mobert and paddling up White Lake to the line between Atikameg and Bryant. The townships of Bryant and Atikameg could be covered in that way. McGill could be covered by following the chain of lakes on to the north of White Lake. Shabotik and Mikano can best be covered by paddling up the Shabotik River on its north and south branches respectively. Flood could be reached by paddling up White River from the old, not the present, station of Bremner, or by taking one of the two existing tote roads that come out to the Canadian Pacific Railway near mile 18 on that railway. Should more detailed information be desired re the several routes for reaching the townships, I will be glad to supply same.

In conclusion I beg to state that your instructions have been carefully followed in respect to the survey of these townships. I have put special attention upon the notes of the timber. I was particularly impressed with the great value of the spruce and banksian pine. I beg to inclose herewith plan and field notes, timber plan, astronomical observations, etc., etc., covering the entire work.

Trusting that my work and this report upon the same will be found to be satisfactory, I beg to remain,

Your obedient servant,

M. E. Crouch,
Ontario Land Surveyor.

The Honourable, the Minister of Lands and Forests,
Toronto, Ontario.

Appendix No. 24.

South Porcupine, Ont., December 1st, 1920

Sir,—I have the honour, in accordance with your instructions to me dated May 11th, 1920, to submit the following report on the survey of certain township outlines, north of the Canadian Pacific Railway in the District of Sudbury.

On August the 19th, my party arrived at the Woman River Station on the Canadian Pacific Railway, and the following morning proceeded down the river an approximate distance of four miles to the point where it intersects the meridian run by O.L.S. Speight in 1909. From this point part of the party proceeded north along this meridian to the 12 mile post, the starting point of the survey, the other members of the party proceeded down the river with supplies to be cached at, or near, the place where the first base line would cross the river.

The survey, which commenced on August 26th, was conducted throughout in strict accordance with your instructions. The base lines were run as chords of parallels of latitude, passing through the township corners. The east limits and west limits of townships were run north astronomically. Frequent observations were taken on Polaris, the notes of which accompany the other returns. In chaining, a clinometer was used at all times, and horizontal distances deduced from the measured slope. Distances across obstructions were measured by offset or triangulation. Many magnetic observations were taken, and the results thereof are shown in the field notes. The lines were well cut out and blazed, and posts of the specified varieties of wood were planted where required. Iron posts of the standard pattern shipped by you to Woman River Station, were planted, and the necessary pits, mounds and trenches constructed as called for in your instructions.

Unusually low water in the streams this season made transportation difficult, but this was more than offset by the ideal weather conditions.

Soil.

The country through the lines passed is mostly rough and hilly, but in small tracts undulating, and can hardly be classed as agricultural. The soil, except in the swamps and valleys, consists of a few inches of leafy loam and 12 to 18 inches of sand or clay on bed rock, as a rule. The swamps, like all others of Northern Ontario, have varying depths of moss and muskeg.

Timber.

Approximately the western half of Dore and Garnet appears to have been burnt over six years ago, and the ground is now covered with semi-decayed fallen timber, and a new growth of small poplars and birches. The remaining portion of the territory, except in small strips along streams and lakes, apparently had been burnt over about 30 years ago, and is now covered with a thick growth of healthy timber, large areas of which are pulpwood size. A few white and red pines, survived the fires, and are now thriving apparently. The varieties of timber are spruce, balsam, white birch, poplar and banksian pine on the high lands, and cedar, small tamarac and black ash on the low lands.

Minerals.

The greater part of the rock throughout the country is granite and greenstone. Many small stringers of quartz were observed, but no large veins. Small

stringers of hematite were noted in several places along the line between Heenan and Fenton townships, but are not likely of any economic importance.

Water Powers.

There are three small water powers on the Ridout River within the limits of the land surveyed, and one larger power, but in a dry season like this, the amount of power that could be developed would be almost negligible.

The water in all lakes and streams is clear and pure.

Game.

Large and small fur-bearing animals were numerous. Beaver work was seen in or along nearly all lakes and streams, and there were many indications of timber wolves, fox, lynx, fisher, otter and bear. Moose were very plentiful, and a few indications of red deer were observed. Partridge of different varieties were very plentiful also. The lakes and streams contain pike, pickerel, trout and whitefish.

I am submitting with this report a general township plan, a timber plan, field notes, account in triplicate and the required affidavits.

I have the honour to be, Sir,

Your obedient servant,

(Sgd.) Chas. V. Gallagher,
Ontario Land Surveyor.

The Honourable, the Minister of Lands and Forests,
Toronto, Ontario.

Appendix No. 25.

Peterborough, Ont., December 10th, 1920.

Sir, -I have the honour to submit the following report on the survey of township outlines in the district of Sudbury performed by me during the past season, agreeable with your instructions of May 21st, 1920.

According to your instructions, I commenced the survey at the north-west angle of the township of Strathearn, from this point I ran due north astronomically twelve miles, this line being the west boundaries of the townships of Hill and Ramsden. From the north-west angle of the township of Hill I ran the south boundary of the township of Buckland due west astronomically to the north-east angle of township number thirty-seven, and from this point I ran the line between the townships of Buckland and Delmage north astronomically six miles. From the latter point I ran west astronomically six miles to the north-west angle of the township of Delmage. I then returned to the north-east angle of Delmage and ran the north boundaries of Buckland and Ramsden due east astronomically twelve miles. I then proceeded to the north-west angle

of the township of Hill, and ran the north boundaries of Hill and Marshall and the east boundary of Ramsden. I then ran the east boundary of Mageau north six miles. From this point I returned to the north-west angle of the township of Mageau, and ran the north boundaries of Mageau and Racine. After completing this line, I ran to the south-west angle of Mageau township. From this point I ran the east boundary of Hill south six miles and picking up the northern boundary of Strathearn I ran east to the north-west angle of the township of Cochrane, thus completing the survey allotted to me.

As to the general character of the country through which these various township outlines pass, I may say that it is evident that all this section was swept clean by fire about the year 1865, and it is also evident that since that date other fires, evidently not so destructive, have swept through this particular section. All this country is now grown up with poplar, white birch, banksian pine and spruce, running up to eight and ten inches in diameter, and generally speaking, very thick underbrush of various kinds.

This country is very rolling and rocky, made up practically of a continued series of high hills and deep valleys, making the work of cutting lines very slow and laborious indeed. Along the north boundaries of the townships of Buckland, Ramsden, Mageau and Racine, and extending from one to three miles southerly, the country is more of an undulating character, with larger timber, consisting of spruce up to ten and twelve inches, poplar, yellow birch, white birch, balsam and banksian pine up to fifteen inches and a few scattered white pine up to thirty-five inches. All the country passed over by me is very rocky and I am sorry to report totally useless from an agricultural standpoint. An exceptionally large number of lakes of various sizes were met with, interfering greatly with the progress of the work. The shores of these lakes are, generally speaking, high and rocky, and the water pure and good. The fishing, however, was not found to be even fair. I found the deflection of the magnetic needle to average five degrees west of the astronomic north and although fluctuating considerably at many points, no mineral deposits were seen or found.

The only game noticeable in this country are moose, which are fairly plentiful throughout this entire section. Astronomical observations for the purpose of verifying the courses of the lines were taken whenever practicable, returns of which will be found on the proper pages of the field notes. The iron posts supplied by the Department were placed and the pits and mounds made at the exact points or as near the exact points as possible.

Accompanying this report I also beg to submit the field notes, a general plan showing the topography of the country. Also timber plan, etc., all of which I trust will be found complete and satisfactory to the Department.

I have the honour to be, Sir,

Your obedient servant,

J. W. Fitzgerald,
Ontario Land Surveyor.

The Honourable, the Minister of Lands and Forests,
Toronto, Ontario.

Appendix No. 26.

North Bay, Ont., June 8th, 1921.

Sir,—In accordance with your instructions dated May 11th, 1920, we have made a survey of certain township outlines in the District of Sudbury, and beg to submit the following report.

The starting point for this survey was at the fourth mile post between the townships of Cavell and Carew. From this point we ran our first meridian two miles north astronomically, where a wooden and iron posts were planted to indicate a corner of Cavell, Carew, Fingal and Edith townships. We continued this meridian north astronomically six miles, one chain and fifty and one-half links for the west boundary of the township of Fingal.

From the iron post planted to indicate the south-east angle of Edith township, we ran our first base line west astronomically on a six mile chord a distance of six miles and twenty-two links to intersect the east boundary of Township 16. This intersection is two chains and ninety links south of the north-east angle of said Township 16.

From the iron post planted to indicate the south-west angle of Fingal township, we ran our second base line east astronomically on six mile chords a distance of twelve miles to form the south boundary of Fingal and Arbutus townships.

From the sixth mile post on this second base line we ran our second meridian north astronomically, twelve miles and ninety-nine links to intersect base line run by C. V. Gallagher, O.L.S., during the season of 1920. The posts at this intersection were planted by him as we had arrived at this point some time previously.

From the sixth mile post on this meridian number two, we ran our three base line east astronomically on a six mile chord a distance of six miles, one chain and forty-one links to its intersection with meridian number three, which was then run from the twelfth mile post on base line number two. This meridian number three was run eleven miles sixty-four chains and thirty-one links to intersect the south boundary of the township of Frater. This intersection was made twenty chains, seven and seven-tenths links east of the first mile post on the south boundary of said township.

We then ran our base line number four from the sixth mile on meridian number two west astronomically on six mile chord, a distance of six miles, one chain and forty-seven links to its intersection with meridian number one.

General Characteristics.

The area embraced by this survey is rolling land with a large percentage of the acreage in spruce, tamarac and cedar swamps, and a few open, marshy areas. Almost the entire area was fire swept, which probably occurred during the construction of the Canadian Pacific Railway.

Through the townships of Arbutus and Huffman are several lakes and streams, which have been and are being used as canoe routes northerly from Biscotasing.

Soil.

The soil is sandy throughout the area. The swamps have moss and mulch overlying the sand.

Timber

The timber is small, due to being fire swept. A few scattered areas have timber of commercial size, but a fine harvest of lumber is growing, which will be a valuable asset in fifteen or twenty years.

Rock.

Very few outcrops of rock were encountered. No contacts were observed nor economic mineral discovered.

Game.

Large game is plentiful. Tracks of moose, red deer, and bear, were seen daily. Small fur is also there, and from reports, trapping has been carried on extensively.

Accompanying this report are plan, field notes, accounts, etc., all of which are respectfully submitted for your approval.

We have the honour to be, Sir,

Your obedient servants,

McCauslan & Anderson,
Ontario Land Surveyors.

The Honourable, the Minister of Lands and Forests,
Toronto, Ontario.

Appendix No. 27.

Toronto, January 20th, 1921.

Sir,—We have the honour to submit the following report on the survey of certain township outlines north of the Canadian Pacific Railway in the District of Sudbury, made by us during the past summer, under instructions from your Department dated 21st May, 1920.

Upon the receipt of the instructions, arrangements were made for the organization and equipment of the necessary party, and on the 15th of June a party was assembled at Dalton, on the Canadian Pacific Railway. The following day a search was made for the iron post planted in 1893 by O.L.S. Stewart, to mark the intersection of the line between townships 42 and 43 with the northerly boundary of the Canadian Pacific Railway. This post has disappeared but a post planted at that time by Mr. Stewart to the south of the Canadian Pacific Railway right of way was found in position, and by measuring northward a small mound of stones was found around what had been the site of the post sought for. A substantial wooden post was planted by us, in lieu of the missing monument, and a cairn of stones built around it.

An observation for azimuth having been obtained, the survey was commenced the next day by extending northward the line between townships 42

and 43. At a distance of 57 chains and 69 links from the point of commencement, an iron post was planted to mark the chainage of three miles from the south boundaries of the townships. Standard pits were dug to the north and south and a wooden post was planted as required by your instructions. From this post we continued north on the line between townships 42 and 43 to the line run by O.L.S. Stewart delimiting the north boundary of township 43. The iron post planted by him was found 8 links west of our line. A standard iron post with pits and mounds, was planted at the intersection and the old post was removed. From this corner we ran east along the south boundary of township 44. The party then returned to the south-west corner of township 44 and ran the line between townships 44 and 45 north, to the intersection with the north boundary of township 45 as defined by O.L.S. Stewart. Mr. Stewart's post was found 7 links west of our line. It was removed, and one of the standard posts was planted at the intersection.

Dog Lake intersects the west boundary of the township of Stover about one mile north of the south-west corner of the township, and the boundary line was carried across the lake before we proceeded to run the boundary between the township of Stover and township 44. We ran east a distance of six miles to the township corner, which lay in a small lake, locally known as Ruby Lake. The iron post, properly marked and monumented, was planted three chains south of the true corner of the line between township 44 and the township of Lang. Wooden posts were planted at the intersection of the township lines with the north, east and west shores of the lake. From this corner we ran the line between the townships of Stover and Brackin north to Crooked Lake and the boundary between the township of Brackin and Lang east to Missinaibi Lake. We then proceeded south along the boundary between township 44 and the township of Lang to intersect the south boundary of township 44, run by us. The south boundary of the township of Lang was then run easterly six miles. Returning we picked up the north boundary of the township of Lang on the west shore of Missinaibi Lake and continued it east to chainage six miles.

We then ran south to intersect our south boundary of the township of Lang. As the intersection came on bare rock, the corner was marked by a cross chiselled in the granite and the iron post was planted on the south boundary of the township of Lang three chains west of the true corner.

Returning to the north east corner of the township of Lang, we ran north, delimiting the east boundary of the township of Brackin. The south shore of Missinaibi Lake was reached at a chainage of about two miles and a quarter, and with the exception of the crossing of the island of Reva and another small island, the rest of this boundary lies in Missinaibi Lake. The chainage was carried forward by a triangulation based on the west shore. Having established the line on the north shore of the lake, we proceeded via Crooked Lake and Dog Lake to the west boundary of the township of Stover on our way running the remainder of the line between the townships of Stover and Brackin. The west boundary of the township of Stover was carried northward to the corner of the township and the line continued northward along the west boundary of the township of Rennie to O.L.S. Niven's base line of 1900. We then returned to the south-west corner of the township of Rennie and ran east between the townships of Rennie and Stover to the east boundary of the township of Stover. From the intersection the boundary between the townships of Rennie and Leeson was run north to O.L.S. Niven's line and the boundary between the townships of Leeson and Brackin east to Missinaibi Lake and the east boundaries

of these townships. The east boundary of the township of Leeson was then continued from the point established on the north shore of the lake to O.L.S. Niven's base line, thus on the 3rd of September completing the survey.

All the east and west lines were run as chords of the parallels of latitude, passing through the corners of the respective townships. Frequent observations were taken on Polaris throughout the survey. The notes of a number of these accompany the field notes.

All lines were well opened out and carefully blazed. Where possible, cairns of stones were built about the posts planted and, except in a few instances where recent fires had laid bare the country, each post was referenced to two bearing trees. Wooden posts were selected from the most durable material available in the vicinity of each mile post and the posts themselves firmly planted. Great care was taken to plant the iron posts in the most workmanlike manner possible, and every effort was made to so dig the trenches and pits that they would comply fully with your instructions and be permanent witnesses as to the positions of the posts.

General Features.

The area embraced in these townships lies mostly to the north-east of the height of land, but township 44 and parts of the townships of Lang and Stover drain southward to Lake Superior. The other townships are drained by the head waters of the Missinaibi River, Dog Lake, Crooked Lake and Missinaibi Lake form an excellent canoe route across the centre townships and numerous other small lakes crossed by our lines.

The surface is hilly throughout, and the township of Lang and the south-west part of township 44 are decidedly rough.

In the northerly two townships, considerable areas of cedar swamp were encountered. We are not in a position to say, however, whether the length of the swamps where crossed by our lines is really indicative of their extent throughout the townships. These swamps represent the only possibilities of the land from an agricultural standpoint, as elsewhere the country is a succession of rock and granite ridges, absolutely unsuited to agriculture.

Timber.

Part of the forest south and west of the height of land has recently been lumbered. Messrs. Austin and Nicholson have a tie camp in operation near mile 5 on the south boundary of the township of Lang, and some thousands of ties had also been taken out during last winter from the country adjacent to Dog Lake.

Between Crooked Lake and Missinaibi Lake, in the townships of Lang and Brackin, there is apparently a very considerable area of good jack pine and spruce and various other smaller stands were crossed by our lines. Probably not more than 35 per cent. of the area of the townships surveyed has escaped fire within the last fifty years. About 40 per cent. of the township of Lang was burnt over, apparently about twenty years ago, and an extensive area north of Crooked Lake suffered about the same time. Both these areas are now largely covered by a dense growth of young jack pine.

The rapid strides now being made in the development of the air ship and aeroplane suggest that in the near future it may be possible to supplement the information gained from a township outline suvery by air photographs of the

interiors of the townships. This should give a good general idea of the actual value or otherwise of the timber within the area covered, besides furnishing data for the charting of waterways, etc.

Water Power.

As the height of land runs through these townships, the streams are insignificant, and there are no water powers capable of development within the area surveyed.

Minerals.

A considerable variety of rock was met with, especially in the southerly townships, and while no precious or economic minerals were seen, thorough prospecting may reveal deposits of value. During the summer, nickel was reported south of Dalton, but the extent or value of the find is unknown.

Game.

Moose were seen at various times, and signs of bear and beaver noted. Pike and pickerel were plentiful in the streams and lakes. Lake trout are said to be present in Ash Lake. In general, however, the game is not so plentiful as in some other districts of Northern Ontario, owing probably to persistent hunting and trapping by Indians and others from Missinaibi.

We have the honour to be, Sir,

Your obedient servants,

Speight and vanNostrand,
Ontario Land Surveyors.

The Honourable, the Minister of Lands and Forests,
Toronto, Ontario.

Appendix No. 28.

Pembroke, Ont., February 7th, 1921.

Sir,—I have the honour to submit the following report of the survey of certain township outlines in the District of Sudbury, made by me under instructions from your department, dated May 12th, 1920.

I left the Canadian National Railway at Foleyet Station with my party, using wagons to move my outfit about seven miles over a good portage road to the north end of Ivanhoe Lake, and proceeded up the lake to the meridian run by T. B. Speight, O.L.S., in 1909, and finding witness post planted by him at forty-two miles plus ten chains, I chained south on his meridian and estabished the corner of Carty and Pinogami Townships, then from observations I ran my first base line west astronomically a distance of five miles and seventy-nine

chains and sixteen links, and planted iron and wooden posts with mounds and pits, establishing the corner of Evans, Warren, Carty and Pinogami townships. From this corner I continued my first base line west, establishing the line between Warren and Evans townships, and then, returning to township corner above referred to, I ran my first meridian north to intersect base line by O.L.S. Speight, and south astronomically a distance of six miles, establishing the corner of Evans, Pinogami, Biggs and Hellyer townships, from which I ran my second base line east to Speight's meridian and west astronomically a distance of six miles, establishing the corner of Sandy, Murdock, Evans and Hellyer townships, this being the starting point of my first meridian, and continued west on my second base line to intersection with the east boundary of the township of Chewitt. I then returned to my second meridian and ran north to intersection with my first base line and continued to intersection with the south boundary of the township of Paul, then returning to my second base line, I ran south on my second meridian between Sandy and Hellyer townships. Returning to my first meridian, I ran south astronomically between Hellyer and Biggs townships a distance of six miles, establishing the point of commencement of my third base line, and continued south between the townships of Raney and Rollo to intersection with base line run by O.L.S. Young, 1920, I then returned to point of commencement with my third base line, and ran east astronomically to Speight's meridian, and west to intersection with my second meridian, and continued west to intersection with the east boundary of the township of Gamey. I then returned to my second meridian and produced it south to intersection with O.L.S. Young's base line already referred to, establishing the boundary between Crockett and Raney. Base lines were all run on chords of latitude and frequent observations for azimuth were taken and recorded in field notes. Wooden posts were planted at every mile and iron posts, pits and mounds planted, and bearing trees taken where specified in instructions. Where posts and monuments could not be established at exact chainage, witness posts and monuments were established as shown in the field notes.

Soil.

We did not encounter any land suitable for agricultural purposes; the soil is either sandy or gravel with boulders, and occasional outcrops of rock. The surface is generally rolling, with comparatively small level areas of swampy land.

Timber.

Forest fires have destroyed the timber over a large portion of area covered by this survey. All of the townships of Crockett, Raney, Rollo and all of Biggs excepting a small triangle in north-west corner of the township; that portion of Hellyer lying south of a line drawn from fourth mile post in west boundary to the second mile post on east boundary, and being now covered by dense growth of jack pine, poplar and white birch from two to six inches in diameter. This old brule also extends into south-east corner of Pinogami. A considerable quantity of jack pine and spruce of commercial value is to be found in the north-west portion of Hellyer, the south-east half of Evans, that portion of Pinogami north-west of Ivanhoe Lake and a strip from one to one and one-half miles in depth along south-east side of the lake, and the south and east part of Carty township; a few scattered areas of white and red pine were seen along banks of Ivanhoe Lake in Pinogami township. In the townships of Sandy, Murdock and

Warren, the north-west portions of Evans and Carty, there are scattered areas of jack pine and spruce, but timber is usually too small at present for commercial purposes.

Minerals.

No indications of economic minerals were found.

Streams and Lakes, Etc.

What was known as the Pishkanogama Route from Ridout Station on C.P.R. passes through south-east corner of Crockett township to south end of lake formerly known as Pishkanogama Lake, now called Ivanhoe. This lake is navigable through townships of Hellyer and Pinogama, but is now about fifteen feet lower than its original level, due to a washout at north end of lake, but I understand surveys are being made to build a dam which will restore lake to within about five feet of its original level. On both sides of this lake the hills rise to a height of from one hundred and fifty to two hundred feet, with a thick growth of timber in Pinogami township.

There are a number of inland lakes of considerable size in townships of Raney, Rollo, Warren and Carty. There is a canoe route from Ivanhoe Lake through Hellyer and Sandy townships to Trout River, but stream is shallow and not much used.

There are no water powers capable of development. Ivanhoe Lake can be used for storage purposes.

Game

Moose and game are plentiful, and there are many beaver colonies throughout the whole area. Speckled trout up to one and one-half pounds were taken in Raven River, Township of Murdock, and I understand are found in lake in south-west corner of Warren township.

Generally speaking, the area covered by this survey is valuable only for its timber reserves and will be of considerable value as a source of pulpwood if fire is kept out and young timber allowed to mature.

Accompanying this report are a plan, field notes, timber plan, with usual affidavits and accounts in triplicate.

I have the honour to be, Sir,

Your obedient servant,

Herbert J. Beatty,

Ontario Land Surveyor.

The Honourable, the Minister of Lands and Forests,
Toronto, Ontario.

Appendix No. 29.

PEMBROKE, ONT., February 18th, 1921.

SIR,—In accordance with instructions from your Department, dated the 12th of May, 1920, I have surveyed certain township outlines in the District of Sudbury, and have the honour to report thereon as follows:

I proceeded to Ridout Station on the Canadian Pacific Railway arriving on the 13th of June, and spent a few days hiring men from various points, finally on the 15th of June, with two O.L.S. assistants and a full party, I was ready to proceed with the survey.

The post from which I was instructed to commence my survey had become obliterated, but after considerable searching I located the iron post in a cairn of stone, planted by O.L.S. John McAree in 1902, on the south side of the Canadian Pacific Railway right of way, marked "R" on the north side; XXII on the east side, and XXIII on the west side. At this point I took an astronomical observation from azimuth, and upon measuring north from this point one chain and fifty-six and two-tenths links (1 ch. 56 2 10 lks.), the distance shown in McAree's field notes, across the Canadian Pacific Railway right of way, I located a cairn of stone, but no post. At this point I planted a spruce post and then ran my first meridian north astronomically between townships XXII and XXIII, a distance of three miles, fifty-eight chains and twenty-six and six-tenths links (3 m. 58 ch. 26 6 10 lks.), where I planted an iron post in the prescribed manner establishing the corner of townships of Tooms and Greenlaw, being the point of commencement of my first base line, which I ran west between townships XXIII and Tooms to the intersection of the northerly production of the line run by Ontario Land Surveyor McAree in 1902 between townships XXIII and XXIV, thus establishing the north-west angle of township XXIII and the south-west angle of township of Tooms. From this point I ran north astronomically between the townships of Tooms and XXIV to the intersection of the south boundary of the township of Lackner. My first meridian was continued north between townships of Tooms and Greenlaw, and my first base line was run east along south boundary of Greenlaw a distance of six miles, where I established the corner of Greenlaw, Cunningham, number XXI and number XXII, being the point of commencement of my second meridian, and I continued my base line along south boundary of Cunningham to intersection with Speight and van-Nostrand's meridian at a point three chains and fifty-two links (3 ch. 52 lks.) north of his XII M.P. Returning to point of commencement of second meridian, I ran north astronomically a distance of six miles, establishing corner of Greenlaw, Denyes, Swayze and Cunningham, the point of commencement of my second base line, and continued this meridian north between townships of Denyes and Swayze. Returning to the second base line, I ran east astronomically between the townships of Swayze and Cunningham to intersection with Speight and vanNostrand's meridian at a point six chains and fifteen links (6 ch. 15 lks.) north of his XVIII M.P. I then ran west astronomically on my second base line between the townships of Denyes and Greenlaw to intersection with my first meridian, and continued west astronomically between the townships of Halcrow and Tooms to intersection with the west boundary of the township of Lackner. I then returned to my first meridian and produced it north between the townships of Halcrow and Denyes to a point distant twelve miles from my first base line, establishing the north-east angle of Halcrow and the north-west

angle of Denyes, the point of commencement of my third base line, from which I ran west astronomically along the north boundary of Halcrow to the east boundary of the township of Gamey. Returning to my first meridian, I ran east astronomically along the north boundary of Denyes township to intersection with my second meridian, and continued east astronomically along the north boundary of Swayze to Ontario Land Surveyors Speight and vanNostrand's meridian, completing the field work of my survey.

All lines were run with the transit as true meridians or chords of latitude, passing through the township corners. Frequent astronomic observations were taken and recorded in my field notes. The measurements were taken with a two chain type and on sloping ground the clinometer was used. The lines were posted in accordance with instructions and iron posts of the new style were planted and witnessed by pits and mounds in the prescribed manner.

Physical Features.

The entire area covered by the survey is undulating or hilly country, with many rock outcrops. The Ridout River, a sluggish stream from twenty-five to fifty links wide, flows north-easterly from Ridout Station on Canadian Pacific Railway in township XXIII, across the north-west corner of township XXII, and is joined by the Wakami River, a larger stream about one chain in width in the township of Greenlaw, and continues north-east through the north-west corner of the township of Cunningham and the south-east corner of Swayze. This river is navigable with a canoe, but is very crooked, and there are five short portages between south boundary of Greenlaw and junction with Wakami River. From the junction north the stream is from a chain to two chains wide, with a fair current and two short portages in the township of Cunningham. There is another small river flowing northerly through the township of Tooms, Halcrow and the north-west corner of Denyes; this river is also navigable with a canoe, but is quite shallow. The lakes are very numerous, some of which are of considerable size, as shown on my plan.

Timber.

The only timber of commercial value met with is in a small area comprising the north-west quarter of Greenlaw, the north-west quarter of Tooms and a small portion in the south-east quarter of Halcrow and part of the south-west quarter of Denyes. In this area there is some very good jack pine from six to fourteen inches in diameter, with spruce, birch, poplar and balsam of good size. With the exception of a few swamps in which there is green timber of spruce and cedar, from six to twelve inches, the balance of the area covered by the survey is an old brule, densely grown up with small jack pine, birch and poplar, ranging from two to five inches in diameter, which, if the fire is kept out, will make a valuable forest in the future.

Soil.

I am convinced that there is no agricultural land within the whole area. The soil is of a light sandy nature, strewn with stones and boulders. In the swamps there is generally about a foot or two of black muck covering boulders.

Minerals.

No economic minerals were seen though on the line between Swayze and Cunningham, in the first mile and in the fifth mile, as shown in my field notes I intersected mining claim lines.

Game and Fish.

Moose are very plentiful and an occasional red deer was seen. Most of the lakes and streams are inhabited with beaver. Small game is said to be numerous and trapping in this country is quite profitable. The only fish caught were pike and pickerel of a fair size; they seem to be quite plentiful in all the streams and lakes of any size.

Water Power.

In the northerly part of the township of Cunningham, there is a falls on the Ridout River of about twenty feet, but the shores of the river are low and storage would be poor. There is another falls of about thirty feet in the township of Halcrow, but owing to the low water, flow being small in volume, neither of these are of value without storage, and an estimate of horse power available could only be made after a careful survey to ascertain drainage area, etc.

Accompanying this report are a general plan, a timber plan, field notes of the entire survey and the usual affidavits and accounts in triplicate.

I have the honour to be, Sir,

Your obedient servant,

A. C. Young,
Ontario Land Surveyor.

The Honourable, the Minister of Lands and Forests,
Toronto, Ontario.

Appendix No. 30.

Survey of Township Outlines Along the Wagamacie River, District of Timiskaming.

Ottawa, October 14th, 1921.

Sir,—In accordance with your instructions dated May 12th, 1920, I proceeded to run certain township outlines west of the Ground Hog River, and south of the National Transcontinental Railway.

My assistant, Mr. Fred Webster, left Ottawa on June 3rd, and had our party in readiness for me when I arrived in Fauquier on June 10th. On June 11th, we started up the Ground Hog River, later entering the Wagamacie River. The latter river is for the most part quite shallow and very rapid at that time of the year, and it was with considerable difficulty that we were

enabled to reach Wagamacie Lake. This lake is about three miles long, and one and one-half miles wide. We followed the river southerly till we came to Sutcliffe and Neeland's meridian, run in 1919, and followed this line northerly till we came to the thirty-three mile post on the Seaton-Griffin meridian. We continued this line northerly three miles to the township corners. We then ran the Seaton-Fenton chord and the Slack-Griffin chord, after which we continued the Fenton-Slack meridian.

After seeing the Griffin-Slack Chord well started, I had to return to Ottawa, as I had received on the day of my departure, a subpoena to appear as Engineer in a case which was coming up for trial shortly. On my arrival in Ottawa I immediately secured the services of J. E. Lyon, O.L. Surveyor, and sent him up to my party, and reported the proceedings to the Department. Just after I left I sent in another man for the party, and he brought tales of fabulous wages being paid for men, with the result that half the party left. My assistant, Mr. Webster, came out and replaced these, and the work went on.

Arriving at the Fenton-Staples, Casselman-Slack corner, the party ran east to the Wagamacie River, where we had our main cache. This cache was then moved west to the township corners, and after dividing the party, Mr. Lyon ran west on the Fenton-Staples chord, and Mr. Webster ran north on the Staples-Casselman meridian.

After going some distance, they sent back for more provisions, and found that our cache had been completely cleaned out by bears. Mr. Webster then ran as far as he could on the available grub, i.e., one and three-quarter miles west on the Staples-Sulman chord. He then returned and ran east of the Wagamacie River a day's run, to the six mile post and came out.

Mr. Lyon got as far as Lake Saganash, and after losing considerable time trying to get suitable triangulation points, returned when his grub gave out, and came to Fauquier about August 20th. As it was impossible to get any men to return, they came to Ottawa.

After it froze up in November, I sent a small party in, but they were unable to finish the work. In June, 1921, we again went in, finishing our contract on July 17th, 1921, by completing the Fenton-Staples Chord, the Slack-Casselman Chord, the Staples-Sulman Chord, and the Shanly-Staples Meridian.

The country traversed, with the exception of the northerly boundary Staples, is low, wet country, covered with mixed timber of fair quality, about thirty per cent. of which is over eight inches in diameter, and suitable for lumbering, while the remainder is fair pulp wood.

The north boundary of Staples is high, undulating land, and has been burnt over at one time. At present it is covered with small, second growth timber of little value. This brule covers part of the Staples-Casselman Meridian, but the timber is poor. The brule also extends along the Shanly-Staples Meridian, where the timber is somewhat better on the first and seventh miles, the remainder being of little or no commercial value.

The soil is mostly clay or clay loam subsoil, covered with decayed vegetable matter, and moss.

No economic minerals whatever were encountered.

During 1920 the country was absolutely infested with bees and wasps, as many as forty-four nests in six miles on the Fenton-Seaton chord having to be removed from the line. This was our chief factor in holding up the work.

Frequent observations were taken during progress of the work, in fact, every time it was possible to do so, one was taken.

Plans and field notes of the work are being forwarded.

All of which is respectfully submitted.

I have the honour to be, Sir,

Your obedient servant,

(Sgd.) N. B. MacRostie,
Ontario Land Surveyor.

The Honourable, the Minister of Lands and Forests,
Toronto, Ontario.

Appendix No. 31.

Survey of Township Outlines in the Districts of Sudbury and Algoma.

Peterborough, December 2nd, 1921.

Sir,—I have the honour to submit the following report on the survey of township outlines in the Districts of Sudbury and Algoma, performed by me during the past season under instruction from your Department, dated April 15th, 1921.

I commenced the survey at the one hundred and eight mile post on Ontario Land Surveyor Alexander Niven's base line, surveyed during the seasons of 1899 and 1900, which point is about 15 miles south-west of Peterbell Station, on the Canadian Northern Railway. After taking the necessary observations for latitude and azimuth, I ran due south astronomically twenty-four miles to the north boundary of the Township of Mageau, surveyed by me during the season of 1920. All this line passes over a very rough and rocky country, heavily timbered with spruce, poplar, banksian pine, white birch and cedar. The land along this line is totally unfit for cultivation. The country traversed over is, however, very valuable and contains an immense quantity of pulpwood.

Having completed the above meridian line, I proceeded to the north-west angle of the township of Pattinson, and produced the west boundary of that township due north astronomically six miles, being the boundary line between the townships of Floranna and Sadler. The country passed over on this line is very similar to that already described, i.e., rough and rocky, and heavily timbered with spruce, poplar, banksian pine, white birch and cedar, with alder and willow scrub, and a large quantity of windfall.

On the completion of this line I moved to the south-east angle of the township of Sadler, from which point I ran north astronomically six miles, being the boundary line between the townships of Sadler and Alcorn. The country along this line is rough and rocky, and is timbered with spruce, banksian pine, balm of Gilead, balsam, white birch and cedar, the spruce, cedar and balm of Gilead running up to sixteen and eighteen inches in diameter. There is very little of what is usually termed agricultural land along this line.

After completing this line, I proceeded to the south-west angle of the township of Lincoln, from which point I ran due west astronomically on nine mile chords along the line between the townships of Copperfield and Lipsett on the north, and Floranna, Sadler and Alcorn on the south, a distance of about twenty-one miles, where I intersected my first meridian line. The character of the country along this line is very similar to that already reported upon—rough and rocky, and very heavily timbered.

Having completed the above line, I came east to the south-east angle of the township of Lipsett, and south-west angle of the township of Copperfield, and ran the boundary line between these two townships north astronomically to the south-west angle of the township of Bonar, from which point I ran the line between the townships of Lloyd and Lipsett due west astronomically to intersect Ontario Land Surveyor Speight's meridian line surveyed during the past season. The country along the north and west boundaries of Lipsett is much the same as that already reported upon—all rough, and with the same varieties of timber.

Having completed the lower part of the work, I moved my camp and outfit to the iron post planted by Ontario Land Surveyor Speight on his meridian line six miles north of Ontario Land Surveyor Niven's base line, from which point I ran due west astronomically on nine mile chords along the south boundaries of the townships of Conking, Nebotik, Makawa and Moorehouse. In all a distance of thirty-six miles, where I intersected the east boundary of the township of Simpson, three chains and eighty-three links north of the south-easterly angle of said township. All the country traversed by this line is rough and rocky, and is of little or no agricultural value. The easterly twenty-five miles is heavily timbered with spruce, banksian pine, white birch, balm of Gilead, poplar, balsam and cedar, running up to eighteen and twenty inches in diameter, and in some places with a dense undergrowth of alder and willow. Along this part of the line there are also a few scattered red and white pine, running up to thirty inches in diameter. The westerly eleven miles of the line is through a country that has been frequently swept over by fire, and commonly called "brule country." This tract is covered with the usual small scrub which follows a fire, white birch, poplar, banksian pine, etc., up to four and six inches in diameter, with alder and willow underbrush.

Observations for latitude and azimuth were taken very frequently, all the work closing very satisfactorily. Wooden posts were planted at the end of each mile and iron posts every three miles, according to instructions. All the pits and mounds were made very carefully and where it was not possible to construct these properly, which was quite frequently the case, owing to the rocky nature of the country, a witness post was planted and witness mound, etc., constructed according to instructions. The lakes, rivers and streams, which are all numerous in this country and crossed by the various lines, contain good pure water and an abundance of the usual kinds of fish. Game appears to be very plentiful, particularly moose, which could be seen almost daily, and in spite of centuries of trapping, the beaver, otter, fisher and mink are still very numerous. Nearly all the country passed over by me this season is very rich in pulpwood, but I am very sorry to say, very poor from an agricultural standpoint. The variation of the magnetic needle averages from three to five degrees west of north, but it is a very uncertain quantity.

Accompanying this report are field notes of the survey, a map of the township outlines and a timber plan, all of which I trust will be found complete and satisfactory.

I have the honour to be, Sir,

Your obedient servant,

(Sgd.) J. W. FITZGERALD,
Ontario Land Surveyor.

The Honourable, the Minister of Lands and Forests,
Toronto, Ontario.

Appendix No. 32.

LITTLE CURRENT, ONT., January 31st, 1921.

SIR,—I have the honour to submit to you the following report on the survey of Lake Penage and part of the Whitefish River, including Walker Lake, Bear Lake and Long Lake, to the east limit of the Whitefish River Indian Reserve, according to instructions from your Department dated Toronto, May 4th, 1920.

Having proceeded from Little Current by train on 1st July, and canoe, from Willisville, situated on the first lake up the Whitefish River, I arrived at the east limit of the Whitefish River Indian Reserve on Long Lake on Saturday evening, July 3rd.

Commencing at the said east limit of Whitefish River Indian Reserve, the work was continued with very little interruption and completed on the 9th of September. We arrived back at Little Current on the 11th of September.

With only one or two exceptions, all posts planted were of cedar, not less than 4 inches square; in most cases they are 5 inches, some are six inches, and properly marked. Every post, with only one or two exceptions, is mounded up with stones, forming a cairn, which at nearly every post has a base of five feet, and about two feet high. Where a post was merely driven, it is noted in the traverse. All posts were also planted well above the flood water, caused by damming the lakes in river driving.

On Lake Penage a careful triangulation was made throughout from several bases, which were measured and remeasured with a steel tape. Stadia readings were made on several of the triangulated distances, a table of which I have shown in the notes, with the resultant difference. In plotting my work across Berths 90 and 91, I was obliged to apply this difference in order to close reasonably with the recorded measurement of the line between those Berths.

In several places, where no other check was available, the measurements were carefully duplicated and compared.

Posts were planted on all islands, except on small, bare rocks where no loose stones were available to mound them, and properly marked and their

position is shown approximately on the traverse sheet. There were planted also posts about a mile apart on the shores and numbers cut thereon as shown in red on the traverse sheet.

I have the honour to be, Sir,

Your obedient servant,

T. J. Patten,
Ontario Land Surveyor.

The Honourable, the Minister of Lands and Forests,
Toronto, Ontario.

Appendix No. 33.

Survey of the Southerly Parts of the Ground Hog and Kapuskasing Rivers and Tributary Streams and Lakes, Districts of Sudbury and Algoma.

Cobalt, Ont., February 1st, 1921.

Sir,—In obedience to your instructions dated May 2nd, 1919, and further instructions of May, 1920, to traverse certain lakes and rivers in the Districts of Sudbury and Algoma, I have continued the work, and beg to report as follows:

1.—Routine of Work.

On May 14th, I left Cobalt with my party for Kukatush, on the Canadian National Railway at the Ground Hog River Crossing. After caching part of my supplies at McLeod's store, I moved the party to Kasaswaychin Lake and commenced the survey of a chain of lakes which give a short route to Sahkatawichtah and Rice Lakes.

We finished survey of Kasaswaychin Lake on May 28th and moved camp to Katagi, the next lake, on May 29th. The survey of Katagi and Atekepemeska was finished June 10th and Arbeesee Lake commenced on the same day. Arbeesee Lake was completed on June 12th and camp moved to Sahkatawichtah Lake on June 13th. On June 16th, we had completed a portion of Sahkatawichtah which I was compelled by bad weather to leave unfinished in 1919, and camp was moved to the first portage en route to Rice Lake. On the morning of June 17th, when I called on the party to carry on up to Rice Lake, two of the men, Wilfred McLeod and J. J. McDonald, refused to go on, saying the wages were too small and the work too hard. Charles Sheppard, Howard Johnston and Robert McLeod remained. Leaving Sheppard and Johnston to guard the supplies, I left with Robert McLeod for Kukatush. I employed E. B. Bourke as assistant and James White as cook, both of North Bay, and arrived back with them at Sahkatawichtah Lake on the night of June 23rd.

On June 24th I moved the party to Rice Lake and completed the survey

of it on July 6th. From here we moved to Opeepeesway Lake, finishing this survey on July 15th.

On July 16th, we moved camp about half-way to Kukatush and arrived there on July 17th.

On July 19th, we commenced the survey of Ground Hog River. Having more trouble with men, I sent Bourke to North Bay for others. Bourke was unable to get men, but I finally got two in Sudbury. We finished survey of the Ground Hog River on August 17th.

The party was then moved by train to Trout River, which was finished on September 4th. Camp was then moved to the north boundary of Kapuskasing township and the survey of Kapuskasing River commenced. This was the final survey of the year, and was completed and the last men paid off on September 30th.

The following is the mileage of the traverse:

	Miles
Kasaswaychin, Katagi, Atekepemeska and Arbeesee Lakes	60.0
Rice Lake	44.0
Opeepeesway Lake	39.0
Sahkatawichtah Lake	4.0
Ground Hog River	87.0
Trout and Kapuskasing Rivers	97.0
Total	331.0

2.—Method of Survey.

(a) Instruments Used.—The traverse was made throughout by transit and stadia. Azimuth angles were used and also the angle to the right was measured between stations. The stadia rods used, read direct to tenths of links. The targets were about two feet long by about six inches wide, one being firmly placed at the top of the rod, and the other moved to the correct position by the rodman. A supply of white linen was carried and the targets newly covered from time to time.

The accuracy of readings was checked from time to time by readings on chained lines and also on the sides of triangles calculated from chained base measurements. They were found to be very accurate.

(b) Field Notes.—One form of field notes was kept throughout the course of work. The notes were transcribed in ink and carefully checked. They show: station, azimuth, distance, angle right, bearing and, under Remarks, the point on which the reading was taken.

(c) Observations were taken frequently on Polaris for azimuth. The results are shown in the field notes.

(d) Posts and Blazed Trees.—Along the banks of the rivers and around the shores of the lakes, trees were blazed at intervals of about one mile and were marked: 1 M., 2 M., 3 M., etc. Records of these are shown on the plans and in the field notes.

On islands stump posts were made. A good sound tree was felled and the stump squared and marked with a letter, "A," "B," "C," etc., except in some cases when the island was very small, when a tree was blazed. The bearings shown to posts and trees are measured with the transit and are astronomic.

(e) Survey Lines, Township Boundaries.—In all cases where survey lines were found, they were tied in and are shown on the plans. Posts were planted

one chain from the shore on each side of the river or lake, where this had not been done in the original survey.

3.—Descriptions of Lakes and Rivers.

(*a*) *Kasaswaychin, Katagi, Atekepemeska and Arbeesee Lakes:*

Shores.—The shores of all these lakes are very similar, being mostly high and rocky. Back from the water's edge, the rock is covered with a sandy clay and boulder overburden. From different rock exposures I saw, I should say the formation was nearly all granite.

Timber.—Except for a brule near the C.N. Railway and one or two small brules, the timber is of good quality; jack pine, red pine, spruce and birch, averaging about twelve inches in diameter, with some cedar. Logs are at present being driven down a creek from Katagi to Kasaswaychin Lake, and may be driven from as far west as the west end of Atekepemeska Lake. From Arbeesee Lake the water flows south-westerly towards Sahkatawichtah Lake. The creeks could be driven in high water, if well cleaned out.

These lakes, together with a lake about two miles long in McOwen Township, form a very good canoe route to Sahkatawichtah Lake. The only portage not shown on the plan is one of four chains over a small falls at the foot of the lake in McOwen.

(*b*) *Rice Lake.*

Shores.—Except at the north end of Rice Lake, the shores are high and rocky. The formation is nearly all granite.

Timber.—Nearly all the west side and south end of the lake has been burned over and is covered with small birch and poplar. The north end is a spruce and cedar swamp. On the east side of the lake, north of the Narrows, the timber is good, being red pine from twelve to twenty inches in diameter, jack pine, birch and poplar, up to twelve inches.

Islands.—There are about forty islands in the portion of the lake west of Frater township, the largest, containing 37 3/5 acres, six others from 10 to 20 acres, the remainder very small. With the exception of a few of the smaller islands, all are well timbered with red pine from twelve to twenty inches, and jack pine up to twelve inches, with some spruce and cedar.

(*c*) *Opeepeesway Lake.*

Shores.—The shores of this lake are very similar to Rice Lake, being nearly all high and rocky.

Timber.—The timber on the shores of nearly the whole of the lake has been burned and small birch and poplar have grown up. There is, however, at the south-east of the lake, some white pine of from nine to sixteen inches in diameter.

Islands.—There are about twenty-one islands in the lake, all being small, the largest containing not more than five and three-fifths acres. They are nearly all well-timbered, mostly with red pine.

(*d*) *Ground Hog River.*—The survey of the Ground Hog River was commenced at Ground Hog Lake and continued through the townships of Keith, Penhorwood, Reeves, Melrose, Parke, Strachen, Montcalm, Poulett, Hicks, Stringer and into McVicar.

Ground Hog River has a width of from three and one-half chains, just north of the C.N. Railway, increasing to a width of from eight to nine chains in Stringer Township. The banks are, generally speaking, fairly high and well wooded, except where the timber has been burned. Brules and the kind of timber are shown on the plans.

The river was very low in August, when the survey was made, which made the work much easier. In high water, the flow would be very rapid. There are numerous rapids and a few falls. The most important rapids are the Five and One-Half Mile rapids, in the townships of Strachan and Montcalm, and the Ten Mile rapid, from Station 17 in the township of Hicks, through Stringer, to Station 13, township of McVicar. The total fall of the first is eighty-five feet, and that of the latter about the same, the Ten Mile rapids being much flatter. Canoes can be poled or tracked nearly all the way up both rapids, there being three lift-overs in each.

The Pishkanogami River flows into the Groundhog from the west, between Stations 23 and 24, in the township of Montcalm. At its mouth it is only about one and one-half chains wide. The banks are very steep and densely timbered. Cedar grows very thickly and overhanging the stream.

The Natt River empties into the Groundhog at Station 17 in Poulett township. It runs parallel and can be used for a canoe route when the Groundhog is high, to overcome the Five and One-Half Mile Rapids. Its width is from one to one and one-half chains.

Waterpowers on Groundhog River.—There are two powers which can be developed without extremely long penstocks for dams. The first is at Station 11 in Reeves Township and has a fall of eighteen feet. The flow measurement was made on August 22nd, 1920, but is away below average for the year, and is not a fair estimate. At this time it was 832.4 cubic feet per second.

The second power is somewhat better, having a fall of twenty-seven feet. It is located between Stations 6 and 8 in Melrose township. I did not measure the flow here, but would say 900 cubic feet per second, or practically 10 per cent. greater than the first falls would be about right for conditions at that time.

In both cases, the present head can be raised from five to ten feet without serious damage to lands upstream.

(*c*) *Kapuskasing River.*—The survey of the Kapuskasing River was commenced at the north boundary of Kapuskasing township and continued through the townships of Amundsen, Davin, Buchan, Clouston, Allenby, Maude, Concobar and Shaney.

Kapuskasing River has a width of about three and one-half chains at the north boundary of Kapuskasing township, and carries this width through to slightly north of the north boundary of Allenby. Through Concobar and Shaney the width increases to almost seven chains on the north boundary of Shaney.

The banks, with the exception of where rapids are shown, and at one or two points, are low, with a width of from ten to twenty chains where the ground rises to the average height of the country, say probably, one hundred and fifty feet above the river.

Timber.—The river is practically free from brules and the timber is nearly the same through the whole length surveyed, being cedar up to ten inches, poplar up to twelve, spruce from four to twelve, with some small balsam. There is the odd jack pine, but none of any great importance.

Waterpowers.—The most important power on the portion of the Kapuskasing surveyed is just north of the line between Buchan and Davin townships, between Stations 3 and 6. The falls itself measures 16 feet, but the total fall, including the rapids, is 33 feet.

The next is a falls of 10 feet in the township of Shaney, at Station 17. There are no others of importance.

(*f*) *Trout River.*—The banks of Trout River are very flat and covered with grass in most places for about ten chains. The country is very low and level.

Timber.—The timber consists of jack pine from four to eight inches, poplar, birch, small spruce and dead tamarac.

There are no waterpowers of importance.

Accompanying this report are:

Plans—	*Sheets*
Kasaswaychin, Katagi, Atekepemeska, Arbeesee Lakes	1
Rice Lake	1
Opeepeesway Lake	1
Sahkatawichtah Lake	1
Groundhog River	8
Trout River	2
Kapuskasing River	5

Field Notes.—Two field books containing notes of all surveys.

The above is respectfully submitted.

I have the honour to be, Sir,

Your obedient servant,

(Sgd.) T. G. Code,

Ontario Land Surveyor.

The Honourable, the Minister of Lands and Forests,
Toronto, Ontario.

Appendix No. 34.

Fort William, Ont., February 2nd, 1921.

Sir,—We have the honour to report that in accordance with instructions of 6th May, 1920, in regard to traverse of certain rivers and lakes in the District of Algoma, we started out on May 27th, having secured the necessary supplies via C.N. Railway, and by special arrangement were dropped right at Nagagami Crossing, about 5 o'clock in the afternoon, giving us ample time to get our camp up and supplies under cover for the night. I was also enabled to get an observation on Polaris.

The next morning we started the traverse of the Obakamiga River. It took us one week to traverse this stretch of river until it flows into the Nagagami Lake. The land in the near vicinity is barren of timber with the exception of spruce and cedar (mainly) which grow densely along the river banks, in places hanging over the river and intertwining themselves in trees on the other side. This necessitated clearing out before any progress was made. In addition, the river overflowed its banks in many places, and here hubs had to be driven and a lot of clearing out and cutting before sights could be obtained.

Lake Nagagami was rather easy going except when we struck the islands, and here the mainland was so cut up that it made progress slow. There were

also some days when we were unable to go out on account of heavy seas, the lake being shallow and squally.

On the 14th of June, Mr. Kirkup had to return to town to procure two more canoemen, as our Indians had left on short notice. He rejoined the party on the 17th June with two men, and continued down the river.

The country tributary to the Nagagami River is in a general way low, level, clay country, covered with about two feet of moss and a small dense growth of spruce. Along the bank of the river the timber grows a little heavier but is scattered. As we neared the south boundary of McMillan township, we struck better country. Banksian pine and poplar ridges with sandy loam, and within the township of McMillan we found it to be rather heavily timbered with spruce. We tied into the Hudson Bay Company's Post on the Nagagami Lake, but it was deserted, and from appearances has not been used for several years.

The party arrived at the Transcontinental Railway on the 6th July and spent three days there repairing our outfit and getting everything ready for the next stretch of river. Mr. Kirkup had to go to Hearst to secure supplies and also one canoe as the other freight canoe had been ruined on the first part of the trip. He was also fortunate in securing the services of two good French-Canadians for freighting, who stayed with him throughout the job.

On the 9th July, the party started out again and packed supplies, etc., from the track to the north limit of McMillan township. From here they started to traverse once more and continued down the Nagagami and Kenogami Rivers to the south boundary of the Indian Reserve on the last mentioned river, tying in to the Hudson Bay Company's post at Mamawimattawa.

There is some good spruce timber in the township of McMillan, but north of there, through the townships of Fintry and Auden, it is scattered and scrubby, the soil being clay loam, very rocky. Just north of the last-mentioned township we struck a big brule about twenty years old, which, it is said, extends from the C.P.R. to the Hudson Bay. At any rate, it follows the river as far north as we travelled. It is clay country and, speaking to the Hudson Bay Company's factor, he said it was very productive and will grow almost anything. Mr. Kirkup also personally saw two or three good fields of potatoes at the Hudson Bay Company's post.

Fur-bearing animals are very scarce north of the Transcontinental Railway, and the Indians had very poor luck last year. Fish are also rather scarce.

On the 31st July, the party started back up the Kenogami River and made fair progress with the traverse, as the river is wide practically all the way. It is swift, shallow and rapid. There are no falls or heavy rapids and with six inches to a foot more water it could be called fairly navigable. There are high clay banks nearly all the way, covered with red shale. The country on either side has all been burnt and is now covered with second-growth poplar and a dense growth of willows. The moss has been burnt off and dried up, leaving a light clay loam covered in places with one or two feet of black muck and moss. This would make really good farm land. It is swampy in places.

The Pagwachuan River we found very dry, making our moves difficult. The river appeared to be in shelves or terraces, in some places seven or twelve feet deep, and suddenly so dry that we would have to drag our canoes. We ran rather short of supplies before we reached the Transcontinental on the 26th August. Here more supplies were secured and the party proceeded upstream and travelled to the boundary between the Districts of Algoma and Thunder

Bay, returning to the Transcontinental Railway grade on the 6th of September and entraining the next day for Fort William.

Timber.

In a general way there is no timber of economic value with the exception of the east side of Lower Nagagami Lake, the township of McMillan and in the near vicinity, and the northern part of the township of Bicknell. Outside of this there is nothing but old brule covered with second-growth poplar, and in some cases banksian pine and open swamps, with small spruce.

Game.

South of the Transcontinental Railway, speckled trout and pike abound in both the Nagagami and Pagwachuan Rivers. As regards the fur-bearing animals, they are also plentiful. We saw many moose and bear and signs of beaver and muskrat. North of the Transcontinental Railway we saw several moose, but no fur-bearing animals, nor any sign of their having been there. In conclusion we would say that we can only cover the territory in a general way in our report. However, the notes of timber and soil have been put on the plan in detail. We found in the course of preparation of the plan that owing to the small scale we could not show all our intermediate readings as so many bearings and lines made too much confusion. It will also be found that on some islands there are no trees marked or posts planted. These were omitted because there was no growth on these islands with the exception of long grass, and they are no doubt swept in the spring by the heavy flow of water.

Water Power.

Several waterfalls of various natures were met with in the course of the traverse. These were all of a small nature, with two exceptions, one at Gull Rock Portage, on the Nagagami River, and one in the township of Clavet; the former, according to information obtained, could develop 5,904 horsepower, and the later, 413. The heads of these falls were noted in the traverse and are shown in the field notes, together with a cross section of the river at these points.

Soil.

The soil in general is red and white clay, with clay loam in places and sandy loam on the ridges. It is generally speaking, good soil for agricultural purposes. It is rather rocky on the west side of Lake Nagagami and through the townships of Fintry and Auden, and north to the Three Portages on the Nagagami. North of this there are little or no rocky outcroppings.

During the months of June and July we experienced very heavy cold rains, but lost very little time as it generally happened that we moved on those days. The months of August and September were exceedingly dry as regards rainfall. There were no serious accidents or losses throughout the whole trip, although it was rather hard on the canoes, the four of which we used being practically done for, as they had to be dragged over the river bed so many times on account of the low water. This we did to expedite the work, as carrying the canoes would have slowed up the work very much, especially as there were no portages at these points. The waters of these streams seem to rise very rapidly, with a slight rainfall, but they drop even quicker.

Mr. Kirkup met Dr. Williams of the Geological Staff on the Kenogami River. He had taken exactly one week to come down to the mouth of the Pagwachuan River from Pagwa with two canoes. This trip is usually made in one day and a half. This will give some idea of what had to be contended with, especially going upstream.

The plots of traverse of the Nagagami, Kenogami and Pagwachuan Rivers are now completed and are being forwarded to you, with observations, accounts and vouchers in triplicate.

We trust all will be found in order.

We have the honour to be, Sir,

Your obedient servants,

BINGHAM & KIRKUP,
Ontario Land Surveyors

The Honourable, the Minister of Lands and Forests,
Toronto, Ont.

Appendix No. 35.

SAULT STE. MARIE, Ont., February 12th, 1921.

SIR,—Under instructions from you dated May 4th, 1920, to continue Missinaibi Lake and River surveys in the Districts of Algoma and Sudbury, I commenced organizing for this work on May 18th, 1920. I left Sault Ste. Marie with complete survey equipment and four men, for Missinaibi Station on main line of Canadian Pacific Railway. From Missinaibi Station I travelled by canoe on Dog, Crooked and Missinaibi lakes, and reached the point of commencement on this year's operations at Missinaibi Lake on May 26th.

For description of Missinaibi Lake please see my report of last year, as there was only a small portion of the work on this lake to complete.

The system of survey was carried out similarly to last year's work. Clearly marked bench marks were established at all the possible places for water power development. Levels based on Canadian Pacific Railway elevations at Dog Lake were carried through and checked out on the Canadian National Railway bench mark on Missinaibi River bridge near Peterbell Station to within one foot. This was checked again at the railway bridge crossing the Greenhill River three miles west of Argolis Station, and levels carried up Greenhill River to Greenhill Lake, where a bench mark was established.

MISSINAIBI RIVER, TOWNSHIP OF LERWICK.

The outlet of Missinaibi Lake is in the Indian Reserve about twenty chains west of the west boundary of the township of Lerwick, about five and one-half miles south of the north-west angle of the township. At the outlet the banks and bottom are of clay soil with no indication of rock. The last available site for a dam is, in my opinion, at the head of the rapids, forty chains east of

the west boundary of Lerwick, where solid rock outcrops on both sides and with elevation about 1,039 at the river crossing. I did not study topography with particular attention to construction of dams, but I consider that a dam of possibly fifteen hundred feet in length could be constructed to raise the level of the lake about fifteen feet. Apparently there are no better locations down the river.

Township of Coderre.

From this point the river runs south-easterly, north-easterly and northerly and crosses the north boundary of the township of Lerwick at 47.65 chains west of Mile 4½, the total fall to this point is forty feet, comprised in about five different rapids. The banks of the river are of clay soil, with occasional outcrops of rock. The timber is principally poplar, jack pine, spruce and balsam, indications of the river being that a fair yield of pulpwood could be taken off. At high water this wood could be floated to the Canadian National Railway, and there is opportunity for ponding this about a mile below the railway crossing.

The river runs almost due north through the township of Coderre, then turns west along the northerly boundary and runs southwest to westerly boundary. The Canadian National Railway crosses the river by a deck plate girder bridge half a mile east of Peterbell Station. The river is of easy slope from the south boundary to within a mile and a half of the north boundary. From this point to a crossing of the westerly boundary there is a total fall of twenty-eight feet distributed through this distance in many small rapids. The timber is of little value as seen from the river. The soil is of clay land along the shores.

Township of Hayward.

The river enters the township of Hayward about a mile and a half north from the south-easterly angle of the township, then flows generally parallel to the easterly boundary, crossing it and recrossing it at 21.25 chains and 50 chains north of the south-west corner of township of Champlain; thence westerly about a mile and a half to where the Greenhill River enters, and thence in a general northerly direction to the north boundary of the township, crossing boundary at 52.80 chains west of north-east angle of township. Above junction with the Greenhill River, there is a rapids about three-quarters of a mile long with a drop of thirty-three feet, which can be passed by a portage about fifty chains long. Up stream from this to the township of Coderre, there is a very slight fall in the river. Below the junction of the Greenhill River to the head of Split Rock Falls, there is a drop of twenty feet distributed in several rapids. At Split Rock Falls there is a drop of 15.6 feet, the watershed area at this point being approximately 2,300 square miles. There is a good site for a dam at the head of the Falls, with rock outcropping on both sides. The fall could be increased to thirty-five feet by the construction of a dam and flooding back would combine with regulation with Lake Missinaibi and make a probable development of five thousand horse power. (See Appendix No. 1).

The soil is typical clay land with areas of sand and outcrops of rock, including gneiss.

This township is included in the limit assigned to the Hayward Lumber Company. They are chiefly getting out jack pine timber for ties. There are considerable pulp areas distributed through this township.

Township of Champlain.

From the north boundary of the township of Hayward, the Missinaibi River runs north-easterly through unsurveyed lands and enters the township of Champlain at the west boundary about two and one-half miles south of the north-west corner of the township, and then flows north-easterly to the northerly boundary, crossing this three miles east of the north-west angle. This is easy navigation the entire distance, except at Mary Falls, about one mile south of the north boundary, where there is a drop of twenty-four feet in a very short distance. There is a good outcrop of bed rock on both sides of the river, and it is my opinion that a dam could be erected here to flood back the water almost to Greenhill River junction, but this would have to be determined by contour survey. Water at head of Mary Falls is four feet below water at foot of Split Rock Falls. (See Appendix No. 2).

The timber and soil are similar to the township of Coderre.

Township of Ericson.

The Missinaibi River enters this township at the southerly boundary three miles east of the south-west corner of the township and flows in a general north-easterly direction through the township. Very easy current the entire distance, velocity being about twenty chains per hour. About two miles from the southerly boundary of the township the Fire River enters. This river has not been surveyed and is larger than the Greenhill River. A portion of Brunswick Lake is included in this township and can be reached by a fifty chain portage from Missinaibi River.

The timber consists principally of spruce, poplar, balsam, birch and cedar. The north centre portion of the township is principally brule. The soil is of clay with outcroppings of rock, particularly in north-west portion of the township.

Township of Cromlech.

The Missinaibi River enters this township at the south boundary near the 2 mile post and runs in a northerly direction, with very little fall to the north boundary of the township. Half a mile south of south boundary a portage runs eastward connecting to Opazatika Lake through a string of small lakes. The main portion of Brunswick Lake is included in this township within the westerly three miles.

The portion adjoining the river is excellent clay land, timbered with second growth poplar and birch, with fringe of spruce, balsam, poplar and cedar.

Township of Abbott.

The river runs through this township in a general course north, north-west, with very little fall; it is joined by the Brunswick River, which flows almost due north, at a point about two miles south of the north boundary of the township, there being a drop of about twenty-five feet between Brunswick Lake and Missinaibi River. Please refer to separate report on this matter.

The land in this township in the vicinity of the rivers is good clay soil, with occasional outcroppings of rock, timbered with spruce, balsam, poplar, birch and cedar.

Township of Rykert.

The river enters this township about a mile and a half east of south-westerly angle of the township and flows north-east for about three miles, then north for about four and one-half miles, and north-east for about a mile and a half, then north to the northerly boundary at about one and one-quarter miles east of north-west angle. From this point, the river skirts the northerly boundary to within thirty chains of the north-west corner. About a mile and a half downstream from the southerly boundary, there is a rapids with a seven-foot fall; and about three and one-half miles from the southerly boundary, there is a fall (Pond Falls) with a head of seventeen feet. The rock outcrop at head of

Wissanabie River, Township of Rykert.

falls indicates that a dam of about six hundred feet could be built to flood back possibly ten miles and create a head of twenty-five to thirty feet, which might be further increased by excavating a portion of rock outcrop at Devil Cap Falls, about thirty chains downstream. The watershed tributary at this point is approximately two thousand eight hundred square miles in area; if a head of thirty feet were obtained, and Brunswick and Missinaibi Lakes regulated, a development of five thousand horse-power would be possible. The distance from present railway communication is considerable, and it does not appear that this site will be developed in the near future. Through the balance of the township, the fall amounts to about twenty feet, principally in the next two or three miles.

The soil is of clay, timbered with poplar, spruce, balsam and cedar.

Township of Magladery.

The river runs through the south-west corner of the township, being at no point very far from the corner. The current is easy, and soil and timber conditions the same as in the township of Rykert.

Greenhill River or Conking River.

Pursuant to your instructions, I made a survey of this river from the Missinaibi River to Greenhill Lake, a distance of about thirty-five miles. In the first two miles of the river, from Missinaibi to the Canadian Railway crossing, the river falls thirty feet in a succession of rapids, a portage over a mile long being necessary. For about fifteen miles upstream from the Canadian National Railway crossing, the river has a very slight current, and is easily navigable for loaded launches, there being a depth of from ten to twenty feet at low water

Poplar Forest, in Township of Stanton, Missanabie River.

stage. Above this the river is easily navigable for canoe at ordinary stage. About seventeen miles upstream, Reva Falls has a drop of 32.7 feet, and three miles above this, Biron Falls and rapids has a drop of 30.8 feet. Above this, there is an aggregate fall from Greenhill Lake of about thirty-two feet, distributed through about a dozen small rapids. Greenhill Lake is merely an enlargement of the river, only about two hundred feet at its widest point. The watershed area above the two falls is very small, so that power development is out of the question.

The soil consists of clay, with outcroppings of rock at the falls and rapids.

The timber consists of spruce and a moderate quantity of poplar, balsam, and birch—a good deal of it below merchantable size—and scattered areas of jack-pine, large enough for timber. The spruce timber alone would warrant pulpwood operations.

Brunswick Lake and River and Foster Lake.

The survey was made in connection with Missinaibi River survey in 1920, pursuant to your instructions.

Traverse survey was carried up Brunswick River to outlet at end of lake, and the larger part of the lake was traversed by triangulation, with detail filled in by stadia readings.

The lake is of moderate depth and could be easily navigated with small launches; the shores, in general, slope gently upward, but in some places, particularly towards the south end, they are high, rocky and steep. I consider the surface elevation could be easily increased fifteen feet, which would include Foster Lake and spruce swamp at its southerly end, with the exception of the swamps. Flooded area for such increase would probably not exceed one thousand acres. Foster Lake is shallow throughout, with mud bottom; and its elevation is practically the same as Brunswick Lake.

Apparently, there is a favorable site for an impounding dam about two and one-half miles below north end of lake on Brunswick River, where there are small rapids with rock outcrops on both shores. The river is easily navigable for canoes only for the entire length downstream; but upstream it is necessary to resort to trekking.

The soil adjacent to the lake and river is of clay, with frequent outcroppings of rock, interspersed with swamps, as is evidenced by the number of small creeks tributary to the river.

The timber consists principally of poplar, spruce, and balsam, in quantities sufficient to make a fair pulp proposition.

I have the honour to be, Sir,

Your obedient servant,

(Sgd.) C. R. Kenny,
Ontario Land Surveyor.

The Honourable, the Minister of Lands and Forests,
Toronto, Ontario.

Appendix No. 36.

Survey of Part of Montreal River and East Boundary of Timagami Forest Reserve, District of Timiskaming.

New Liskeard, Ont., February 12th, 1921.

Sir,—Under instructions from the Director of Surveys, dated August 24th, 1920, we proceeded to Elk Lake on August 30th, 1921, and thence up the Montreal River to the location of the work. Owing to the extremely low water in the river and the rate at which it was falling, it was considered necessary to at once push forward to the head of Long Rapids, and start the traverse there. Even at this time, there was barely enough water in places to float

the heavily loaded canoes. At this point an observation was taken and the traverse carried forward, permanent stations being left so that the work could be picked up coming back.

Considerable time was spent trying to locate the line between the townships of Kimberley and Cairo, where it first crosses the river. At this point, the country has been burned over several times, the last time being in the early part of the summer of 1920. For a mile or more, either side of the river, what little timber there is standing, is so badly charred that it was impossible to find any blazes. Close to the river, one tree was found having three blazes on it that looked to be an old line. For purposes of closing off the traverse, this was accepted as being the line, and was afterwards found to be nearly correct when the traverse was figured to the second crossing. On account of not being able to accurately locate the line without considerable time and work, no posts were planted and no blazing done.

On the first section of the river in Cairo Township, all mining claims were located and tied to the traverse, excepting H.F. 11, 14 and 13. The fire at this point has swept the country bare, and completely destroyed the posts belonging to these three claims.

At the second and third crossings of the line between Kimberley and Cairo, the traverse was tied in and the line cleaned out, re-blazed and posted. In figuring latitudes and departures of the traverse between the second and third crossings of the line, the departures did not balance within approximately seven and one-half chains. The first mile of the township line was then chained and found to be in error nearly the same amount.

On the second section of the river in Cairo Township, all mining claims were located and tied in, excepting E.B. 2 and E.B. 9. Here, too, fire had destroyed all signs of lines and posts.

From here to the north end of the work, no difficulty was experienced in locating lines and posts of mining claims or townships. These were cleaned out and reblazed and posted where necessary. There was some trouble in finding the portages between the lakes north of Trout Lake, but these were well opened out and blazed when the traverse was run between the lakes.

In figuring the latitudes and departures for the townships of Robertson and Michie, the departures taken separately did not balance within approximately fifteen chains. On figuring the traverse between the south boundary of Robertson and the north boundary of Michie, it balanced very closely, thus showing the error to be on the line between Robertson and Michie.

The traverse was finished on the north end of the work on September 28th, 1920, and the party were down to the head of Long Rapids in Kimberley Township and at work in the afternoon of September 30th, 1920. In this section, all township, concession and lot lines were located and re-blazed and posted where necessary. All the original posts were found, excepting that on the line between lots 4 and 5 in the first concession of the township of Willison. This line was chained to the post on the first concession line for the necessary tie.

Instrument Work.

A Gurley Light Mountain transit with adjustable stadia hairs, was used on this work. Frequent tests of the stadia were made during the progress of the work, but at no time was it found necessary to change the adjustment of the hairs. The high degree of accuracy attained may be judged from the

attached latitude and departure sheets, when balanced against the chained distances on the township lines. The rod used was a sliding stadia rod with a total length of thirteen feet, equipped with a fixed foot target and a sliding vernier target. The rodman, in the front canoe, read the rod and noted the reading. In a few cases, where it was impossible, owing to heavily wooded shore line, to get stations within stadia shot, triangulations of the distances were made by laying off a right angle base of fifty or one hundred feet and reading the angle subtended by this base, and solving for the distance equal to the base by cotangent of the angle. Observations on Polaris were taken as often as possible, and the calculations of these are attached to this report. In some cases, owing to the extremely low water, it was possible to get instrument stations on sand and gravel bars in the centre of the river, and materially added to the speed of the work.

Timber.

Notes on the timber met with during the progress of the work, will be found on the accompanying plan. Much of the country, from the beginning of the work to the west boundary of the Township of Cairo, has been burned over, some of it for the second and third time. There are two fine areas of timber along this route: one of white and red pine, along the shores of Upper Matachewan Lake, and another of jack pine, around the small lakes in the centre of the Township of Robertson.

Water Powers.

Most of the falls and rapids met with on this work, are on the Montreal River in the townships of Kimberley and Cairo, and are shown on the accompanying plan. No good site for a dam exists at the Long Rapids, that would make it feasible to utilize the total drop in this section of the river. In the township of Baden, the traverse was tied to the Power Reserve of Big Bend Falls, which is a short distance upstream on the west branch of the Montreal River from Upper Matachewan Lake. As the falls did not come within the limits of the traverse, no further data was taken.

Buildings and Improvements.

The buildings along the river are of the usual log construction, and are, in most cases, in good repair. There is one frame building at the Matachewan post of the Hudson Bay Company. There are no dams along this route, the only improvement in the river itself being the dock of the Matachewan Gold Mines, a short distance above Fox Rapids, in the township of Cairo.

Islands.

All islands were given a designating letter, which was marked on a tree or post set in a prominent position. A sufficient number of readings were taken to give an accurate outline of the island, and if a closed traverse was, at any time required, it could be figured from the position of the different readings. No attempt was made to run a closed survey of each island, as in many cases it would have necessitated probably half a day's chopping for the entire party, on account of the amount of timber and brush overhanging the shore line.

The groups of islands along the south-west side of the township of Willison were numbered and lettered as shown on the plan of the original survey of this township.

Most of the islands, from the beginning of the work to Lower Matachewan Lake, have been formed from deposits of silt, etc., at the foot of rapids and at the junction with other streams, and are, in many cases, low and swampy and heavily covered with brush, with some large timber growing on a few of the higher parts. Many of them probably change their shape from year to year, owing to the action of the current during high water.

PLAN.

Accompanying this report is a plan, on tracing linen on a scale of twenty chains to the inch, showing all traverse run, together with the information collected on the work. In some cases, such as survey of island, ties to buildings and portages, where a large amount of detail was taken, it was found necessary to insert a plan of the area, on a scale of four chains to the inch, in order that all the information might be clearly shown. In each township, the numbering was kept separate, and for purposes of calculation was considered a separate traverse. On the plan every fifth station was numbered, to assist in locating any particular point. On the traverse sheets attached, the latitude and departure in inches for a scale of twenty chains to the inch, is given for each station, to facilitate the plotting of the traverse.

We have the honour to be, Sir,

Your obedient servants,

(Sgd.) SUTCLIFFE & NEELANDS,
Ontario Land Surveyors.

The Honourable, the Minister of Lands and Forests,
Toronto, Ontario.

Appendix No. 37.

THESSALON, ONT., March 23rd, 1921.

SIR,—In accordance with your instructions, dated May 20th, 1920, I have made a survey of certain base and meridian lines near Lake St. Joseph, in the districts of Kenora and Patricia, and have also made a traverse survey of the portion of Lake St. Joseph which lies west of the meridian line run by myself in 1919, and beg to submit the following report.

The route to Lake St. Joseph is a fairly easy one. Leaving Hudson Station on the Canadian Government Railway, one can go by gasoline boat, via Lost Lake, English River, and Lac Seul, as far as Perch Ripple, the first portage on Root River, which flows into the north-east end of Lac Seul. This portage is about seventy miles from Hudson. The canoe route up Root River is good. There are ten portages, the longest one being over the height of land into Lake

St. Joseph. This portage is about half a mile long, and is much the longest of the ten. The portages are all in good condition, as this route is extensively used by the Hudson's Bay Company for transporting supplies to their posts at Osnaburgh and Cat Lake. The starting point of the survey was about twenty-five miles by the route travelled down Lake St. Joseph from the end of the lake.

The first base line was started at Mile 60 on the meridian line run by myself in 1919, being the boundary between the districts of Kenora and Thunder Bay. This base line was run west, astronomically, for a distance of 18 miles. The second base line was started at Mile 66 on the same meridian line, and was also run west a distance of approximately 18 miles. From the 6, 12, and 18 Mile on the first base line, meridian lines were run north, astronomically, a distance of approximately 6 miles, to intersect the second base line. These meridians are known as the first, second and third lines, respectively.

Each base line was run as a series of six-mile chords of a parallel of lati-

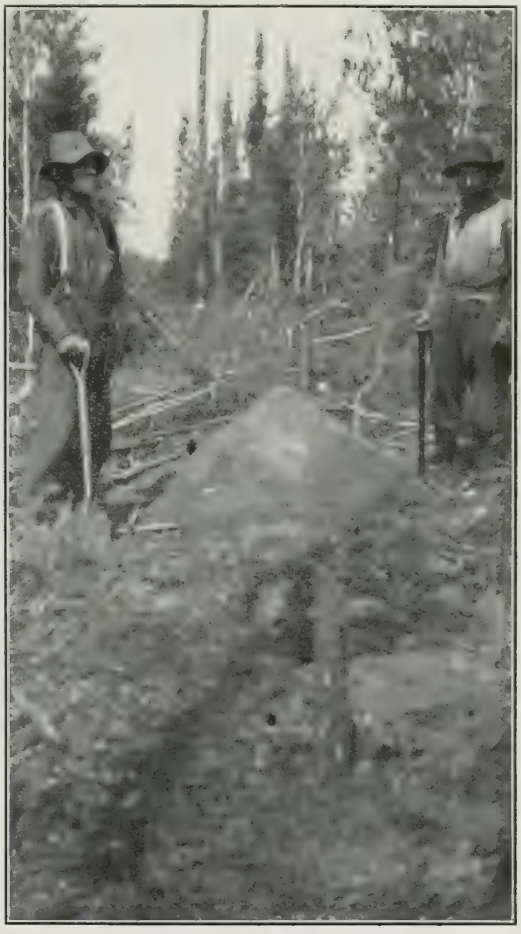
On Root River, Patricia.

tude. The meridian lines were run north-east. These lines were all well cut out and blazed. A substantial wooden post, of the best green timber available, was planted at the end of each mile, except when this point fell in a lake or stream, and was surrounded by a mound of stones wherever possible. Bearing trees were marked with the letters, "B T," after being blazed in a prominent manner, at every post where possible, and the bearings and distances of these trees from the various posts recorded in the field notes. The number of the mile was marked with a scribing iron on the side of the post facing the point from which the line started. Where the end of a mile came in a lake or stream, the post was planted on the nearest shore, and the chainage from the nearest mile was marked on the post with a scribing iron.

At the end of every third mile, wherever possible, a standard iron post, of the type recently adopted by your department, was planted. At these iron posts, pits were dug and the earth from these was formed into two square pyramidal mounds, in the manner described in the general instructions relating

thereto. In some cases, it was impossible, on account of the end of the mile coming in water or on unsuitable ground, to plant standard iron posts and dig pits and erect mounds. In each of such cases, a standard iron post, surrounded by a witness trench and accompanied by a conical mound, was planted at the nearest even chain where suitable ground could be found, from the correct position of the point to be established. These witness posts, trenches and mounds were planted to indicate the following points:

On first base line, 9 mile and 18 mile.



Preparing mounds and pits.

On first meridian line, III mile.

On second meridian line, III mile.

Frequent observations were taken to determine the bearings of the lines run. The greatest variation from the theoretical bearing, found in the survey of the lines, was 2 minutes. The bearing of the first meridian line is north 0 degrees 2 minutes east, astronomically. This was discovered after the line was run nearly all the way through, and it was continued to the end on this bearing.

The traverse of Lake St. Joseph was started at a point on the south side of the narrows of the lake, 59.00 chains north of the 61 mile post on the meridian run by myself in 1919. The whole of Lake St. Joseph, lying west of this meridian, was traversed during the season. Included in this are 470 islands, ranging in size from small bare rocks to several hundred acres in area.

In the traverse, all angles were measured with a transit, and the distances were obtained by stadia and micrometer. The traverse was checked carefully by astronomical observations taken as often as possible, and also by ties to the base and meridian lines run during the season, which intersected the shores of the lake a number of times. Every night the traverse work of the day was plotted on cross-section paper, on a scale of twenty chains to an inch, and by this means any error in the traverse was at once located and corrected. The closing errors in the traverse were remarkably small during the whole survey.

At intervals of about a mile on the shore, prominent trees were blazed on four sides, and marked on the side next the water with the letter "P," followed by the number of the tree, thus, "P. No....." Similarly, the islands were marked by having the letter "I," followed by the number of the island. Each of the trees thus marked was tied to the nearest transit station, the bearing and distance from the station to the tree being recorded in the field notes.

The details of the traverse, showing all measurements, all posts, trees, and other monuments, and all information necessary for the proper interpretation of the survey, have been plotted on a scale of ten chains to an inch, and tracings of these have already been sent to your department. A plan on a scale of one mile to an inch has also been prepared on drawing paper mounted on cotton. This plan shows the base and meridian lines, and their relation to the surrounding country. The shore line of Lake St. Joseph and of all islands within the limits of the survey, have been reduced by a pantograph and plotted on this plan. This plan accompanies this report.

The country around this part of Lake St. Joseph is rolling and rocky. South of the lake, the country is hilly, with ridges of rock and deposits of sand and gravel arising in places, to form rounded hills. The valleys are occupied by deposits of muskeg, and in places by stones and boulders. The easterly part of the country north of Lake St. Joseph, is more level, the first eight miles of the second base line being mostly in swampy country and crossing only a few low ridges. West of this, the country becomes more broken, conditions being very similar to those south of the lake.

There are no areas of any consequence fit for agriculture. Areas of sandy loam, suitable for garden purposes, exist here and there, but the total area of these, in comparison with that of the country as a whole, is insignificant.

The whole country has suffered extensively from fire. Practically the whole of the south side of the lake has been burnt over at different times, and the timber is second-growth of various ages, depending upon the date of the fire. Much of the country has been burnt over more than once. There are a few isolated areas of fairly good spruce in some of the valleys, which have escaped the fires, but these are rather small in comparison with the total area.

North of Lake St. Joseph there is a fairly extensive area which has not been burnt over, and on which there is a good growth of spruce. The second base line enters this area about half a mile west of the starting point, on the meridian of 1919, and continues in it for six miles, to where the line first crosses the northerly bay of Lake St. Joseph, which runs up to the easterly outlet of

Cat River. This is a fairly level swampy area, with low rock ridges, and contains the largest quantity of timber seen during the survey.

The remainder of the second base line and the three meridian lines run almost entirely through burnt country, with second growth of varying ages.

There is a small grove of red pine on the north shore of the bay lying northeast of Island No. 49, near the east end of the part of Lake St. Joseph included in this survey. There would be probably fifty thousand feet of red pine in this grove, and it is the only red pine seen during the survey. There is no white pine whatever, the last white pine tree seen during the season being on an island in Lac Seul.

The second growth timber consists almost entirely of poplar, birch, jack pine and spruce. Along the shores of Lake St. Joseph there is considerable scrubby cedar, but it does not appear to extend inland, as very few cedar trees were observed along the lines.

Many of the islands have also suffered extensively from fire, although

H. B. Co. Post, Osnaburgh, District of Patricia.

some of them are fairly well timbered with spruce, jack-pine, white birch, and poplar of fair size. Information as to this is given in the detailed description of each island which accompanies this report.

The greater part of the portion of Lake St. Joseph surveyed during the season, lies between the first and second base line. The south shore of Lake St. Joseph, from the meridian of 1919 to the first meridian of 1920, is fairly straight and rocky, with occasional sand beaches. The ground rises quite rapidly from the lake, in places reaching an elevation of from 100 to 150 feet above the lake a comparatively short distance back. The north shore in this section, on the contrary, is low and flat, with many broad, deep bays, ending in fairly extensive marshes. Very little rock is exposed in this section, the shores being composed mostly of sand and boulders, excepting in the marshes, and these appear to be shallow, resting on a sandy sub-soil.

West of the first meridian the south shore becomes very much indented. There are many large islands with narrow channels between, these channels

extending back into the mainland in the form of narrow bays, and generally ending in marshes. The north shore is also considerably indented, but the islands are not so large. West of the second meridian, the main portion of the lake narrows down to a channel about four miles long, nearly straight, and from twenty to thirty chains wide. West of this the lake again spreads out into a number of irregular bays, one extending to the south-west for about five miles beyond the first base line, as far as Root Portage, which forms the height of land between the watersheds of the Albany and English Rivers. Another long bay extends for several miles to the north-east, dividing into two branches. The westerly outlet of Cat River enters the northerly one of these branches, at the extremity of which there is a short rapids with a fall of about three feet. The survey was discontinued at this point. Another outlet of Cat River enters a bay which runs north of the second base line a short distance west of the first meridian. Between these two outlets of Cat River lies Blackstone Lake, which is really an expansion of Cat River. This lake is a considerable body of water, with an exceedingly indented shore line crossed in places by the second base line and the second meridian. The second base line crosses a large island which lies between Lake St. Joseph and Blackstone Lakes, the two outlets of Cat River, of which Blackstone Lake is an expansion, forming the remaining boundaries of this island. No number was given to this island, it being treated as part of the mainland as far as the survey of Lake St. Joseph is concerned.

The geological formations in the area surveyed are of great interest. The rocks exposed along the first base line are mostly all granites, excepting near the extreme west end of the line, where it strikes the lake. Along the south shore of Lake St. Joseph the rocks are schists of Keewatin age, the contact between the schists and the granites lying between the first base line and the lake. The granites occur again on the north side of the lake, and on the islands adjacent to the north shore, while the Keewatin series, referred to above, runs along the southern portion of the main body of the lake, outcropping on many of the islands. The schists occur on both sides of the long channel west of the second meridian line, which is referred to above, the contact running along the southern part of the large island which lies between Lake St. Joseph and Blackstone Lake.

Associated with the Keewatin rocks which lie along the southern shore of Lake St. Joseph, there is an iron range, the strike of which follows the general direction of the lake, and which can be traced for many miles. Low grade iron ore outcrops in many places, mostly on the islands along the south shore of the lake, and for a distance of about three miles both east and west of the first meridian. The exposures are numerous and some of them are fairly large. The largest exposures occur in a laminated form, carrying about 35 per cent. of metallic iron, consisting of a mixture of magnetite and hematite. The best sample which could be considered as representing an exposure of any magnitude, contained 44 per cent. iron. No attempt was made to explore this range beyond what was actually necessary for the carrying on of the survey, and such samples as were secured were picked up as the survey progressed. It is by no means improbable that systematic exploration will uncover deposits of merchantable ore.

Traces of this iron range in the form of narrow bands of magnetite, occur at the west end of Lake St. Joseph, south-east of the first mile on the third mer-

idian, and similar outcrops were seen along the strike of the range, at intervals between the outcrops mentioned above.

In the year 1911 I surveyed an Indian Reserve near the east end of Lake St. Joseph, about thirty miles east of the present survey, and observed traces of an iron range which appears to be an easterly extension of this same range. In travelling through the easterly portion of Lake St. Joseph, I have noticed, at several points along the south shore of the lake, very strong magnetic attraction which appears to be spread over a large area. This iron range, from my observation, appears to be about fifty miles long, and the indications are of such a nature, and cover so much ground that I would take the liberty of suggesting that a detailed geological survey be made of this area.

Throughout the greater part of the Keewatin area, the compass needle was extremely erratic. The amount of local attraction was recorded in the field notes wherever it varied from the normal; but in many cases the vertical

Packing Survey Posts.

component of the attraction was so strong that the needle would drag on the frame of the compass or on the glass cover, and no reading could be obtained. These readings are shown on the detail plans of the traverse, of which tracings have already been sent to your department. The points at which exposures of iron ore were observed are also shown on these tracings.

There are no water powers within the limits of the survey; but as stated in my report of last year, there are some falls on the Albany River, east of Lake St. Joseph, where power could be developed.

Lake St. Joseph is well supplied with fish of the varieties common to this north country. Pike and pickerel are very plentiful, and are easily taken with a troll, while whitefish and some lake trout are also taken in nets by the local Indians. Moose are very plentiful, and red deer appear to be coming into this section in increasing numbers. Partridge or grouse, of both the ruffed and Canada varieties, are fairly plentiful, and the number appears to be increasing in the last year or two. Some prairie chicken were also seen; but the

rabbits have almost disappeared. The local Indians report fairly good catches of the ordinary furs during the winter months.

Accompanying this report is a mounted plan on a scale of one mile to an inch, as previously mentioned; also my accounts in triplicate, which I trust that you will find correct. The field notes of the survey and the tracings, showing the details of the traverse, were forwarded to your Department some time ago.

I have the honour to be, Sir,

Your obedient servant,

James S. Dobie,

Ontario Land Surveyor.

The Honourable, the Minister of Lands and Forests,
Toronto, Ontario.

Appendix No. 38.

Parry Sound, October 4th, 1921.

Sir,—I have the honour to report that, in compliance with instructions, dated the 16th of May, 1921, I proceeded to make a traverse survey of certain lakes and rivers in the townships of Harrison and Wallbridge in the District of Parry Sound.

Along with my party, I left Parry Sound on the afternoon of May 30th, by way of the Canadian Pacific Railway, arriving at Naiscoot Station the same evening, where we pitched camp. The following day, after making the usual tests of our instruments, I commenced the traverse of the Nescodaong River. This river, averaging about one and one-half chains in width, has its headwaters in the lake bearing the same name. For the greater part of its way, the Nescodaong River, on its travels to the Georgian Bay, flows through a flat, extending six to ten chains wide. The country then rises into a granite rock. Level stretches, extending a few chains back, are also found along the Big River, sometimes called Giroux Creek. But for a part of the way this river from its headwaters flows through a large marsh of varying widths, where at times the river bed is practically lost. The greater portion of the small rivers are navigable to light craft, but apparently this depends to a great extent upon the character of the year. Owing to the excessive rainfall last spring, and the nature of the ground at that time, the rush of water could only find an outlet in the river basins; consequently many of the old dams were swept away, thus lowering the level of these rivers considerably.

For the most part, the lakes and rivers are lying between high and rocky shores, ranging from ten to twenty-five feet high, some of them even higher, as in the case of the Still River near the Canadian National Railway crossing, where its bank rises into bluff rock, sixty to seventy feet high.

The South Maganetawan River is a fine water route, even by motor boat, for about eight miles west from the Canadian National Railway. The route

from the South Maganetawan to the north branch of the same name, must be made by the portage, as the rapids are too wild in high water, and after the freshets have abated, it leaves the river bed practically dry in many places. Coming into the North Maganetawan, we find a river in most cases several chains wide, with numerous small falls and rapids, at the foot of which the black bass lurk.

Timber.

As these two townships have long been under timber license, very little of the original forests remain. The axe of the mighty woodsman has laid these giants low, leaving in their wake the fuel for the fire to complete the destruction. So, today, outside of certain small areas of maple, birch and hemlock that this fiery monster was not able to devour, very little remains but the charred skeletons of the past. As if to hide this blackened pall, small birch, poplar, balsam, banksian, and white and red pine sprang up. While this pine is still small, a few more decades of protection would make it a valuable asset. Between Nescodaong Lake and Gordon's Lake some very good white and red pine, ranging between six and twenty inches in diameter, was met with. This extends some distance east of what is known locally as One Tree Lake. Areas of varying dimensions of maple, birch, and hemlock decorated the country around Horseshoe Lake, Pike Lake, and along the portage between North and South Maganetawan Rivers. As a rule, the shores of the larger lakes are nearly depleted of timber. This is, no doubt, due to the fact of its presence near these waters, the natural artery of transportation. The stretches along the river flats were clothed with large-sized elm and ash, intermingled with scattered spruce and cedar.

Soil.

Agricultural land, for the most part, is wanting in this country. Along the Still River, extending from Byng Inlet for about three miles upstream, was the only farming settlement met with. The land along this river, in the township of Henvey, is a clay loam, and appears very productive. Small areas along Big River were free of rock, but the country here is too sandy. There are a few scattered beaver meadows producing hay, but these are limited. With the exception of the river flats and numerous small swamps, the townships of Wallbridge and Harrison are rough, hilly, rocky country, unsuitable for agricultural purposes.

Minerals.

As the rock formation here is granite of the Huronic era, no minerals of any consequence have been found. Some very good dykes of feldspar lays along the Nescodaong River in the township of Harrison.

Fish and Game.

Although numerous tourists visit this section of the country, the many lakes and rivers still abound with black bass, pickerel and pike. Red deer grazed in the meadows and several bears were seen, and the wolf made his presence known by his nightly howls.

Water Powers.

No water falls of any importance are to be found in these townships. There are two small falls just east of the Canadian Northern Railway, four to six feet high, also two west of the railway, ten to twelve feet high, on the North Maganetawan River in the township of Wallbridge. At the foot of the falls there is a rapid with a fall, in about a mile, of thirty-eight feet, where a few hundred horse-power could be developed. While there are not large natural water powers to be found, there are places on the Still River where the banks are high and the river valley so narrow that dams could be easily built, making great heads of water.

While farming is out of the question, many of the shores and islands could afford a resting place for tourists. Nescodaong Lake has several suitable tourist's lots, and two beautiful islands, clothed with pine. South Maganetawan, with a fine water route from the Canadian National Railway, has some lovely points with sandy beaches. For those who wished farther to be removed, there is Gordon's Lake and several lakes to the east of it, all connected by good portages.

The township of Harrison was surveyed in 1876 by Thomas Byrne, and the township of Wallbridge by David Beatty, O.L.S., some few years later. Since that time, these two townships have been lumbered over several times, and coupled with the fact that the fires came to devour the remains, the original survey in many cases is nearly obliterated. True it is that many old pine stubs are still standing; but these are mostly burned so badly that blazes cannot be recognized. Along the banks of the larger lakes and rivers, nearly everything was cut, as it was easily taken to the water route, thus leaving not a trace of the former survey. In many cases, and by far the majority, where any traces of the original survey could be found, the marks were on fallen timber that, in a few more years, must readily succumb to the elements, thus obliterating entirely the original survey, as only those lot corners, where an old post has been perpetuated, can any landmark be found.

In reference to our surveys, you will notice that, north-east of Nescodaong and around One Tree Lake, in the township of Harrison, we have added several lakes that were not shown on the original plan as previously laid down. Nescodaong Lake and the lakes to the east of it are considerably higher—no doubt due to the presence of the dam on the Nescodaong River—thus making a motor boat route from the Canadian Pacific Railway to the east boundary of Harrison. These differences are general throughout. In the township of Wallbridge, you will also notice changes. Our plan of traverse will fully explain them. I am enclosing with the report, observations, descriptions of islands met with and area of same, and the bearing of the courses from station to station.

All of which is respectfully submitted.

I have the honour to be, Sir,

Your obedient servant,

J. T. Coltham,

Ontario Land Surveyor.

The Honourable, the Minister of Lands and Forests,
Toronto, Ontario.

Appendix No. 39.

SURVEY OF THE EXTENSION OF THE TOWNSITE OF HEARST, TOWNSHIP OF KENDALL, DISTRICT OF ALGOMA.

COCHRANE, ONT., July 26th, 1921.

SIR,—I have the honour to report that I have completed the survey of Blocks "A" to "U," inclusive, and Lots 506 to 529 inclusive, between the subdivided portions of the townsite of Hearst, as outlined in your instructions to me under date May 27th, 1921, and I herewith enclose certified copy of field notes of said survey; also full expense accounts and other returns necessary for your department.

Under separate cover, I am forwarding by registered mail a plan on tracing linen, giving the measurements and bearings of the south and west limits of of Blocks "A" to "U," and the measurements along the front of each of the town lots 506 to 529 inclusive, said plan being on a scale of three chains to an inch, and duly signed and certified to by me, as required under the Survey Act.

Owing to the change in direction of the East and West streets, which occurs between 7th and 8th Streets, it has been necessary to re-survey lots 500 to 503 inclusive, and slightly alter the frontage of said lots in order to have the new survey conform with the previous subdivision, the axis of the change of direction running somewhat diagonally from the north-east angle of lot 503 to near the south-west angle of lot 500.

I have placed iron posts at the several corners of the Blocks, and also at the front angles of the lots 506 to 529 inclusive, as outlined on the plan which accompanied your instructions, with the following exceptions:

North-east corner Block "S."
South-east corner Block "J."
South-east corner Block "F."

Wooden posts, 2" x 2" were placed at the above three corners, as the number of iron posts expressed to me was not sufficient to post all the corners shown on plan.

All iron posts were marked with a cold chisel, as directed, by placing the letter "R" on the side of the post adjoining the road, and the block number letter on the side adjacent to the block.

The numbers 506 to 529, inclusive, were marked on the lot angle posts planted.

I accepted, as a basis for the above survey, the line between two iron posts in the north limit of George Street, one being at the south-east angle of lot 226 and a second at the south-east angle of lot 210.

Owing to the almost complete disappearance of all original posts of the ormer subdivision, no definite check could be made at the junction of the new survey with the old, as only a few isolated posts are visible on the ground within the settled area of the town, and those are by no means to be relied on as evidence.

The total expense of the survey, as certified by the accompanying accounts, amounts to $875.30, out of which sum I have received advances amounting to $555.00, leaving a balance to the credit of my account of $320.30.

I trust the accompanying plan, field notes, and accounts will meet with your approval, and that you will find the survey has been performed with efficiency and economy.

I have the honour to be, Sir,

Your obedient servant,

(Sgd.) J. LANNING,
Ontario Land Surveyor.

The Honourable, the Minister of Lands and Forests,
Toronto, Ontario.

Appendix No. 40.

FORT WILLIAM, ONT., July 13th, 1921.

SIR,—We have the honour to report that, in accordance with your instructions of date 4th November, 1920, in regard to resurvey of the north three concessions of the township of Pardee, we started out with party on November 15th, and reached there late in the evening, making camp.

We made inquiries from many of the old settlers, who had been in both Pearson and Pardee a number of years, as to any evidence that they had found as to blazes and old lines, and in no case had old blazes or posts been seen.

We, therefore, retraced the south boundary of Pearson township, starting in accordance with your instructions, at the post planted by O.L.S. MacDougall, between lots 4 and 5, Pearson, assuming it to be the east limit of Pardee township, planting posts for Pardee, and renewing the Pearson posts wherever necessary.

We found no trace of the original line, and MacDougall's line was fairly obliterated, most of the way.

We ran south between sections 9 and 10, Pardee, and at the end of the first mile, finding that the topography did not work out with the old field notes, we ran east, crossing the Pine River. Here in the spruce swamp we found sufficient evidence to throw a shortage of 16 chains in the first concession.

This led us to be suspicious that the Pearson south boundary was not the north boundary of Pardee.

We afterwards looked north on this same line as finally located, and found the old original blazes extending for 12 chains into the township of Pearson. We found no posts or bearing tree.

We referred to the Director of Surveys the question of accepting the south boundary of Pearson for purpose of resurvey, or of endeavoring to locate the original north boundary of Pardee as run by Hugh Wilson in 1870, and under his instructions, accepted the south boundary of Pearson as marked by O.L.S. MacDougall, and planted all posts on this line.

On the east boundary of Pardee we found two old bearing trees, one at the line between concessions 1 and 2 and the other between concessions 2 and 3, also several old blazes which lined up fairly well.

This constituted all our evidence on the east boundary, which produced to intersect the south boundary of Pearson, making a jog of some ten chains west from the post, between lots 4 and 5, Pearson, which the Department believed to be on the line between townships of Crooks and Pardee.

On the south boundary between concessions 3 and 4, sufficient old blazes were found to establish the direction of the line; one old bearing tree between sections 11 and 12; an original cedar post and bearing trees in the swamp at the south-west corner, still in a well-preserved condition, were also found.

For the west boundary we ran in a northerly direction, following the blazes which occurred in the first fifty chains, and produced north to intersect the south boundary of Pearson, no further trace being found of the old lines.

It was very rocky, and had been burned over four or five times. This was found to leave a net distance of 320 chains across sections 10 to 13 inclusive.

Timber.

As is well known, this part of the country was stripped of its pine timber several years ago, and fires have ravaged it to a great extent, so that there is really no timber of economical value to be had. What is left of the spruce is being taken out by settlers for pulpwood.

Soil.

The soil in general is clay and clay loam, though badly broken by high hills.

With the building of roads to the settlers, they are satisfied that they can make a success of their operations.

We lost only three days through rain and snow during the months of November and December, 1920, and returned to Fort William on December 23rd. Conditions then became sufficiently bad for resurvey work that, in accordance with your instructions, we decided to suspend operations until spring.

We returned to Pardee in May 3rd, 1921, and completed the running of the lines.

In plan and field notes, we have shown cleatings made by settlers on the north half of concession 1, Pardee. As will be seen according to the lines as fixed by resurvey, part of Mr. Flood's clearing falls on the east half of section 11, located by Auld, and part of Auld's clearing falls on the west half of section 10, located by Gardner.

There is a clearing on the west half of section 7 made by Mr. Pitt, but we have been unable to ascertain whether Pitt has located on this lot on the east half of section 8.

We trust that you will be able to arrange some method of protecting these settlers in regard to the clearings in the issue of patents.

We returned from the field on June 4th, leaving two chainmen to re-post the north boundary, in accordance with the changed circumstances.

This they did, but unfortunately made an error in chainage, which Mr. Kirkup and one man had to go back to correct on January 22nd.

The plan of Pardee and the field notes are now completed, and are being forwarded to you, with observations, accounts, transports and stationery vouchers in triplicate.

We trust all will be found in order.

We have the honour to be, Sir,

Your obedient servants,

BINGHAM & KIRKUP.
Ontario Land Surveyors.

The Honourable, the Minister of Lands and Forests,
Toronto, Ontario.

Appendix No. 41.

QUETICO PROVINCIAL PARK, November 2nd, 1921.

HONOURABLE SIR,—I beg to submit my report for the fiscal year ending October 31st, 1921.

We have had an average staff of ten rangers during the year whose duty was to patrol, repair and build cabins, cut trails, roads, etc. The rangers work in twos and the cabins are built so that at the end of their respective sections every alternate cabin serves the rangers of two or more sections.

We have built two cabins this year, one on Windogoostan Lake, near the eastern boundary, and one on Baptism Lake, also on the eastern boundary. The road to Kawene from Eva Lake was very much improved by the blasting of rocks, for which purpose a box of 60 per cent. dynamite was used, but owing to the unseasonable weather, the drainage was not completed this year. A road for fall and spring use was cut around Eva Lake on the west side, a distance of about ten miles to connect with the road from Eva Lake on the one end and with the road from French to Eva Lake on the other. This road is over a very rough country, but will serve its purpose during the opening and closing season of the water and ice routes, and was particularly needed in case of serious sickness or accident.

I would respectfully draw your attention to the number of tourists who enter the Park from the American side compared with what enters from the Canadian side. Of the angling permits sold, over one-fourth entered from the American side, and of the guides, nine out of thirteen were engaged on the American side. This is owing partly to the access to the Park from the American side, but principally because the Canadian National Railway through trains were not scheduled to stop at Kawene, the chief point of entrance on this side. The result is that the moneys spent by these tourists is spent with American merchants instead of Canadians, as we would desire. I would respectfully recommend that every inducement and convenience be offered to intending tourists to enter the Park from the Canadian side, so that their provisions and outfits might be purchased in Canada, and also that Canadians might be access-

ible as guides to those who require them. I had a barge built on Eva Lake for the purpose of getting in supplies, but the boat with which we tow it is not at all satisfactory. It is equipped with a 5 horsepower twin-cylinder Waterman engine, two of which were purchased three years ago. The hull of both boats are in good condition, and I would recommend that heavier power be purchased for each boat.

Moose and deer are very plentiful, and also fur-bearing animals, particularly beaver, which are increasing very fast. Partridge are so numerous I have counted thirty-eight in the door-yard on one occasion.

I have the honour to be, Sir,

Your obedient servant,

HUGH McDONALD.

The Honourable Beniah Bowman,
Minister of Lands and Forests,
Toronto, Ontario.

Appendix No. 42.

ALGONQUIN PROVINCIAL PARK OF ONTARIO.

HONOURABLE SIR,—I beg to hand you my annual report for the fiscal year ending October 31st, 1921.

Our staff for the past year has been composed of thirty-five rangers, housekeeper and superintendent. Three of the old staff were retired, having reached the age set by the Act, and three new men appointed to replace them.

During the hunting and trapping season these men have been constantly travelling their sections, and owing to the lack of employment generally, they have been kept constantly on the move, the temptation to do some illegal trapping being too great for men who, if otherwise employed, would not do so. No doubt some parties have succeeded in getting away with furs, which, considering the vast area and the many means of entrance into the Park, is not to be wondered at. However, I feel our men have done their best and have kept the Park comparatively clear of poachers. Several have been routed out and their traps and supplies taken, and some have been brought in to stand their trials. Fines have been imposed to the amount of $110, and all traps, etc., taken.

Game of all kinds has very much increased, especially the deer, which are to be seen in numbers wherever you go in the Park. Partridge (ruffled grouse) too are more plentiful than they have been for many years, the past winter having been most favourable both to deer and grouse. Beaver, mink, marten, fisher and otter are also abundant everywhere. Even the sections, such as Joe Lake, where so many were taken out for years, have filled up again. No trapping has been done by the rangers this year in accordance with instructions, and no live animals of any kind shipped from the park. Wolves are numerous in some sections despite the fact that the rangers wage constant warfare upon them, and a great many deer are destroyed by these brutes. Our men have poison

out for them wherever advisable and several have been taken. They come in from north of the Ottawa River every fall, owing to the abundance of deer in the park, and the ease in obtaining food. It is seldom the rangers get a chance to shoot them, but a few are taken in that way. Poison, however, is the main, and in fact the only successful way of getting them.

As a health resort, the Park is becoming very popular, and this year we have had hundreds of visitors all through the season from all over Canada and the United States, also many from abroad. The hotels have been filled to overflowing all through the season. Fishing has been exceedingly good in all sections, some very fine specimens of salmon trout and speckled trout having been taken. The small-mouthed bass introduced into these waters by the Department have proven a great addition and afford splendid sport to the angler.

Apart from the revenue derived from fishing licenses, which this year amounted to $1,919.00, there is a very large amount spent in the province by the parties who visit the park, principally for the fishing, and I would strongly recommend keeeping the lakes along the Grand Trunk Railway well stocked each year so that there may be good angling for parties who cannot go far afield.

While the primary object in setting aside this vast territory was the preservation of our Ontario fur-bearing animals, and I think this should always be kept in mind in dealing with all subjects pertaining to the park, it has become so popular with, not only the people of the province but with the whole of America, that it is evident provision must be made to meet this growing desire of the people to get close to Nature and become acquainted with the wood folk of our Canadian woods. This is a healthy desire and I think well worth encouraging. I would therefore recommend opening up the lakes adjacent to the railway for leasing. Cache Lake is pretty well taken up, but there are the following lakes that could be opened up: Rainy, Brule, Potter, Joe, Source, Lake of Two Rivers and Whitefish. The Grand Trunk Railway touches all these lakes and the timber has all been cut adjacent to them. This would meet the need for many years to come.

We have a number of Boys' School Camps on different lakes, all of which were well patronized this season. The Girls' School Camp, too, under the management of Miss F. L. Case, of Rochester, located on Cache Lake, had some seventy-five inmates for the summer.

Several new leases were applied for on Cache, Rock, Canoe and Joe Lakes, and several cottages were erected.

Rents to the amount of $1,124.00 were collected here. This does not include rents paid by the Grand Trunk and others direct to Toronto.

Regarding bush fires, we have been very fortunate. A number were started along the railway but in all cases they were gotten under control before any damage was done. In the north section they were not so fortunate, but most of the portion burnt over had been cut out and fire had been over it before. The fire tank here has been a great advantage, and I consider one should be stationed at Brent, on the Canadian National Railway, under competent men. This would very much minimize the danger from fires started along the right-of-way, and it is from such fires we have suffered in the past. We seldom have fires started by tourists and it is very gratifying to note the increased interest taken by the people along these lines. The telephone system too has been a great advantage in this and many other ways.

Our staff during the summer months, when there is no danger from trappers, act as fire rangers on their respective beats, cut out portages, repair and build shelter-houses and see that the park regulations are observed in every way.

Some startling reports reach the Department from time to time regarding laxity of the park staff and the large quantity of furs illegally taken out of the park. This has especially been the case with each change of government, but they will, as they have in the past, prove mostly untrue. I have no hesitation in saying that the rangers do their work to the best of their ability and are respected by all who have not a mean desire to make trouble. A great deal of time has been spent in the past in running down such reports, generally to find them either a matter of spite and wholly untrue, or cases of hearsay.

Considerable work was done on the Minnising Road, making it fit for a car to travel, which was highly appreciated by the visitors who had to travel it to Minnising Camp.

I, myself, reach the age set for retiring before the end of the coming year, and while I feel quite competent to continue the work as I have for the past twenty-three years, I am quite willing to retire or remain as the Government may direct. I have given the best of my life to this work, and I assure you, whether I am retired or not, I shall always take the deepest interest in Algonquin Park. The people of Canada are only beginning to realize what a boon it is to them not only as a game preserve and pleasure ground, but as the preserver of the water supply of a large portion of the province, no less than five rivers taking their head here.

The bass supplied from the Government hatcheries were this year planted in Cache, Pollies and Lindies Lakes, and I would strongly recommend a like number being sent next season, also some salmon and speckled trout for adjacent lakes.

I have the honour to be, Sir,

Your obedient servant,

(Sgd.) G. W. Bartlett,
Park Superintendent.

The Honourable, the Minister of Lands and Forests,
Toronto, Ontario.

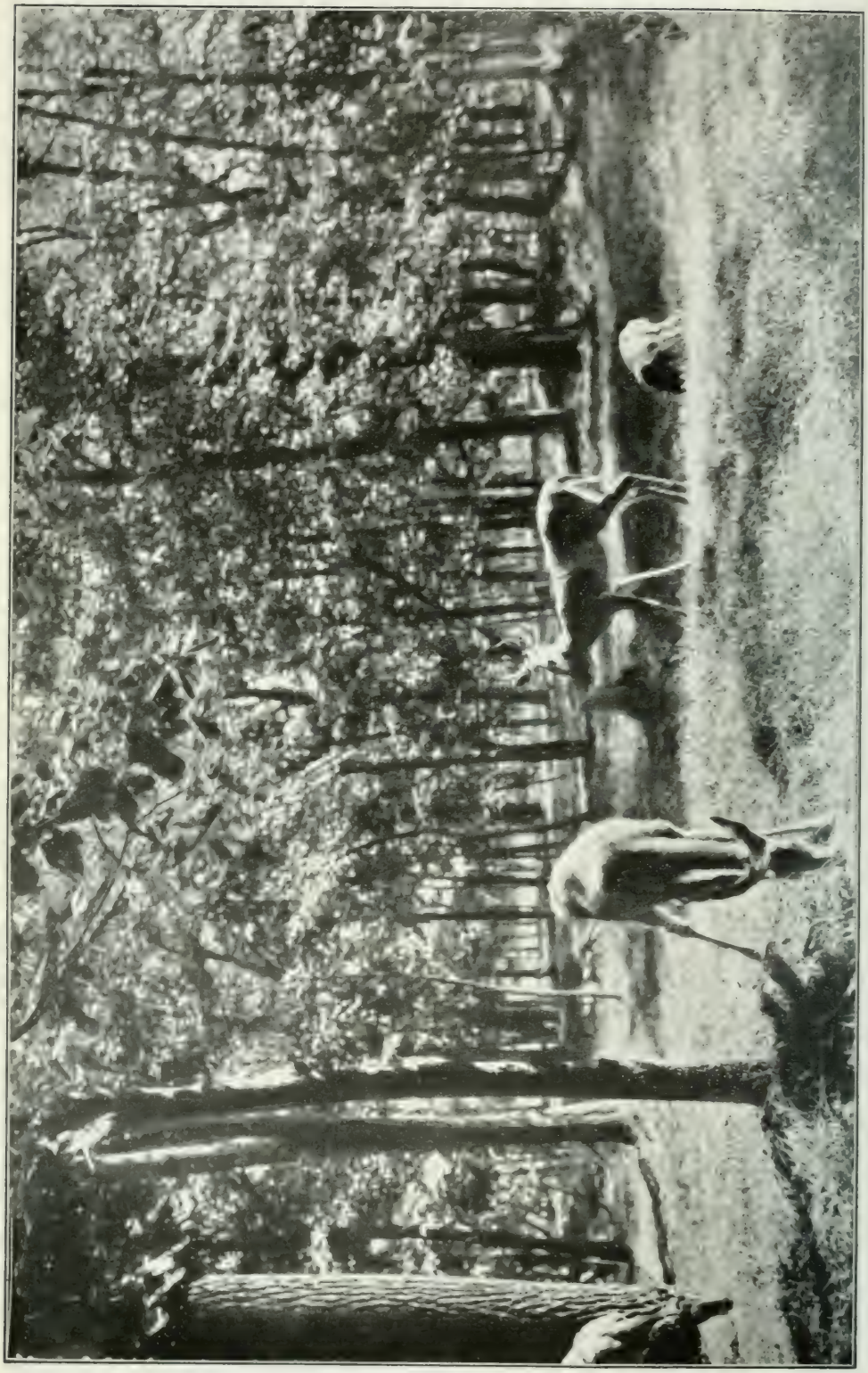
Appendix No. 43.

Rondeau Provincial Park.

Morpeth P.O., Ont., October 31st, 1921.

Honourable Sir,—I beg to submit my report for the fiscal year ending October 31st, 1921.

Rondeau Provincial Park, as a summer resort, is becoming more popular each year, situated as it is at the extreme end of the town line between Harwich and Howard Townships, about four miles south of the Talbot Road Provincial



Red Deer—Rondeau Park

Highway. Many tourists avail themselves of the opportunity of visiting our beautiful park, and as it covers an area of about 5,000 acres and is thickly wooded with all kinds of timber, it affords a great deal of interest and pleasure to lovers of nature.

Both the Eau side and the Lake side are equally popular for the building of cottages, and the surveyed lots on both sides are nearly all taken. Lots have been in steady demand this last summer. Twenty-two new cottages have been erected and twenty-six or more are to be built next season. There are now between fifty and sixty cottages in the park.

Last summer a large number of people availed themselves of the tenting privileges of the park, and many white tents were pitched in the shade of the wide-spreading oaks, while some were up among the "Pines," about a mile up the lake shore.

A certain amount of lumbering was done last winter by taking out dead and deteriorated timber, which was sawn up into different grades of lumber, and will be used for building and repairing whatever may be necessary in the park. As we purchased a planer, this year we are able to put all our own material in shape for building, as otherwise we would have to draw it a distance of 12 miles to get it sized and dressed for use.

This providing of lumber ready to use made it possible for us to reconstruct and repair the old pavilion into a new and up-to-date one, and it is now in good condition for the use of the public in holding public gatherings or for convenient shelter when needed.

One thing that was needed very much was the supplying of hot and cold water to the public. A new building was therefore erected in which a hot water system was installed. This has proved a great boon to the large picnics which come here from great distances, as it has supplied all demands so far, being equal to the occasion in the case of one of the largest picnics ever held here—that of the Howard Councillors and U.F.O., which was held on the 26th of August—the crowd being estimated at around 30,000. A large number of new tables and benches were also made this year and placed in the picnic grounds for the convenience of the public.

As the park has been so well patronized this year, the public store and restaurant did a thriving business, the largest of any previous year.

Last winter several hundred loads of gravel were drawn down the beach, a distance of some four miles, to be used as needed for cement work and repairing of roads. The roads are sandy and they need quite a lot of attention, as holes are very easily worn in them by the constant traffic.

One feature which was an additional attraction to the park this year, was the introduction of a good, well-equipped launch, built by a private party, and used for excursions on Rondeau Bay, and also for running excursions to Erieau and Erie Beach, as well as to other summer resorts to the west of Rondeau Park. This is something that has been needed for some time, and it has proved very popular.

We have had a fairly successful year in rearing pheasants and we have supplied many eggs to people outside the park for propagation purposes.

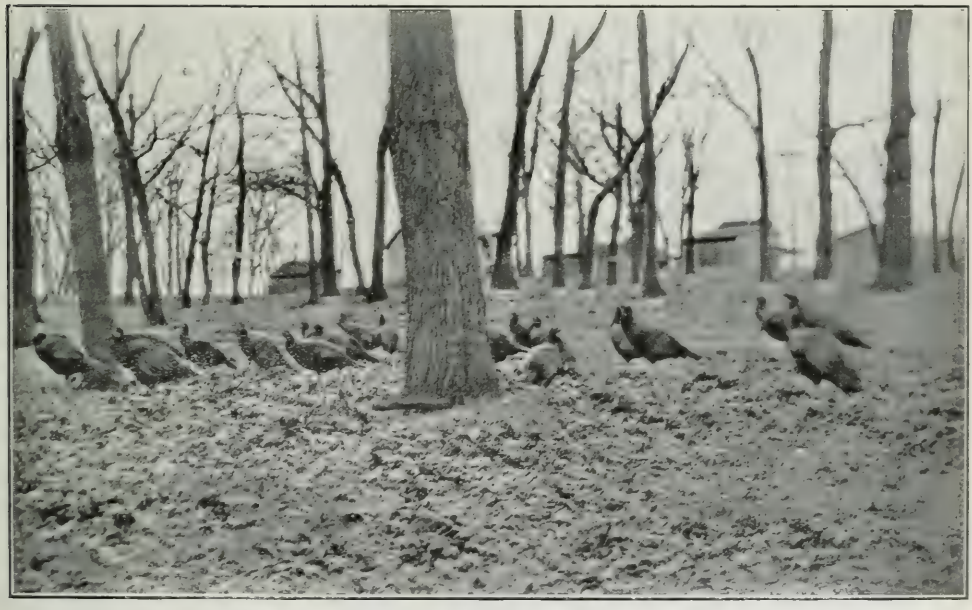
The wild geese and wild turkeys do not increase in numbers very rapidly as there are too many enemies to permit of the young birds coming to maturity.

Deer are very plentiful and are of considerable interest to the visitors. The marshes contain great quantities of muskrat. Some trapping of these rats is done from year to year.

Pavilion and Café, Rondeau Park

Intersection, Rondeau Park.

Wild geese at home,—Rondeau Park.



Domesticated Wild Turkeys,—Rondeau Park.

The colony of beaver is thriving, although it is impossible to give an estimate of their number. Some new colonies are reported outside the park.

The wild duck season has been one of the best in years for lovers of that sport, the ducks coming here by the thousand.

As Rondeau Park is so interesting in every way, those who have visited it once wish to come again, and many communications are received every season asking for accommodation. We can only assist a limited number, however, by securing cottages from private parties who are willing to rent. But there are a great number who wish hotel conveniences and there is nothing provided for as yet in that line. We hope in the near future to see a modern summer hotel erected which will provide ample accommodation and thus make Rondeau Park a most popular and favorite resort.

Yours very truly,

(Sgd.) GEO. GOLDWORTHY,
Superintendent Rondeau Provincial Park.

Honourable Beniah Bowman,
Minister of Lands and Forests,
Toronto, Ontario.

Appendix No. 44.

TORONTO, ONT., October 31st, 1921.

HONOURABLE BENIAH BOWMAN,
Minister of Lands and Forests, Ontario.

SIR,—I have the honour to present the annual report of the work done by the Colonization Roads Branch during the fiscal year ending October 31st, 1921, which in schedule form gives the details of each portion of work undertaken and its cost.

Construction and repair of roads and bridges was carried out as has been the case since the year 1909, first, by the direct expenditure of money by this Branch, and second, by making grants to Municipalities passing Colonization Roads By-laws authorizing expenditures upon certain of their roads. Grants were also made to Municipalities passing by-laws for the purchase of road machinery and for the salaries of Township Road Overseers.

Our total expenditure for the year was $506,180.80. Of this the sum of $293,540.26 was expended directly by the Government on roads and bridges. $176,154.04 was granted towards Colonization Roads By-laws, $2,553.52 towards Machinery By-laws and $552.40 towards the salaries of Township Road Overseers. A further sum of $33,380.58 was expended on inspection of the work, engineering, surveying and locating roads and other miscellaneous items.

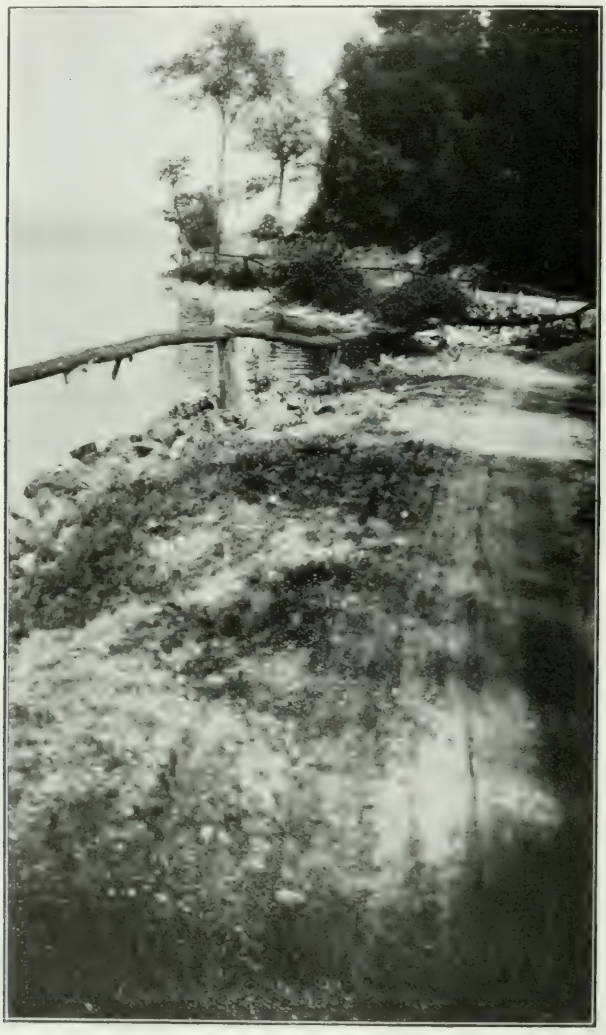
The work carried on by direct expenditure through our Branch, embraced 75.29 miles of new road construction and 540 miles of old road improved, making a total of 615.29 miles. 257.4 miles were surfaced and 62 bridges and 1,284 culverts were constructed. With the assistance of the grants towards the Colonization

Drain in swamp constructed entirely by means of blasting powder.

Pioneer road through rock cut, Muskoka District.

Roads By-laws, 42.01 miles of new road were constructed and 605.75 miles of old road repaired or improved, 334.9 miles of this were surfaced and 61 bridges and 1,260 culverts were built.

During the year several trunk and main roads were surveyed, and are now being mapped. This work is very important and should be continued so that we may have adequate records as to the location of the roads we have built



Wolf Lake, Shore Road, Frontenac County.

and reliable data as to the roads upon which we are contemplating construction in the immediate future.

The labour situation during the latter part of the season approached the normal conditions which existed before the war, and there is every indication that so far as our work is concerned, normal conditions have arrived.

C. H. Fullerton,
Superintendent Colonization Roads.

DEPARTMENT OF LANDS AND FORESTS, ONTARIO,

ANNUAL STATE

NUMBER	TOWNSHIPS	NEW CONSTRUCTION							DITCHED
		Cleared and Stumped		Graded and Shaped		SURFACED			
		Length, rods	Width, feet	Length, rods	Width, feet	Material	Length, rods	Width, feet	Length, rods
1	2	3	4	5	6	7	8	9	10
1	Aberdeen Township roads								40
2	Admaston Township roads								
3	Addington road, Kaladar and Denbigh								400
4	Albermarle Township roads								
5	Algona North Township roads								
6	Algona South Township roads								
7	Allan Township roads	280	36	280	30				
8	Alice and Fraser Township roads	75	30	75	18	gravel	90	8	
9	Airy Township roads								
10	Anson and Hindon Township roads								2
11	Anstruther Township roads								
12	Appleby Township roads	120	16	91	14				
13	Armour Township roads	160	40	160	18	gravel	60	6	
14	Armstrong Township roads	260	50	245	30				
15	Assiginack Township roads								30
16	Badgerow Township roads								
17	Bagot and Blythfield Township roads								
18	Baxter Township roads								200
19	Baldwin Township roads	20	30	150	18	earth	20	8	180
20	Balfour Township roads	40	40	25	30	clay	40	6	20
21	Bangor, Wicklow and McClure Tp. rds.								820
22	Barber Township roads	91	20	87	20				
23	Barrie Township roads								200
24	Barrie Island Township roads								
25	Bedford Township roads								
26	Bedford Tp. Richardson Mine road	320	66	140	22	stone	100	18	280
27	Beauchamp Township roads	100	30	320	22	gravel	10	6	200
28	Bethune Township roads								
29	Bexley Township roads								
30	Bidwell Township roads								15
31	Bigwood Township roads								
32	Billings Townships road	10	30	80	20	gravel	80	8	30
33	Blezard Township roads								100
34	Bonfield Township roads	335	40	175	16				
35	Boulter Township roads	315	40	435	18				
36	Bracebridge-Baysville road	40	30	40	18	gravel	40	5	
37	Brethour Township roads	30	40	570	40	clay	40	6	412
38	Bright Township roads								15
39	Broder Township roads	1,028	30	750	20	gravel	78	6	1,840
40	Bromley Township roads								
41	Brougham Township roads								
42	Brudenell and Lyndoch Tp. roads	40	60	40	30				320
43	Brunel Township roads			60	20	gravel	60	5	
44	Buchanan Township roads								
45	Bucke Township roads								
46	Burleigh Township roads								
47	Burpee Township roads								15
48	Burwash Township roads								34
49	Caldwell Township roads								
50	Calvin Township roads								
51	Campbell Township roads								
52	Camden Township roads								

COLONIZATION ROADS BRANCH.

MENT, 1920-1921.

BRIDGES			CULVERTS		CUT AND FILL		MAINTENANCE							MILEAGE	EXPENDITURE	NUMBER
							Side-Brushed		Graded and Shaped		SURFACED					
Number	Span	Material	Number	Material	Material	Cubic yards	Length, rods	Width, feet	Length, rods	Width, feet	Material	Length, rods	Width, feet			
11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
															$ c.	
			2	wood	earth	969			400	20	gravel	800	6	3.00	$1,477.34	1
					rock	250			250	18	gravel	225	10	.80	323.25	2
			18	cedar	rock	1,560			1,040	16	gravel	1,820	9	6.00	4,900.00	3
					stone	20					gravel	220	5	.75	502.56	4
											gravel	300	8	.94	200.00	5
			4	cedar			400	20	1,570	18	gravel	450	10	5.00	1,509.93	6
			1	wood	stone	4	20	12	410	24	gravel	630	5	2.88	1,499.70	7
			2	tile					970	18	gravel	1,475	8	5.50	1,671.80	8
			11	cedar					710	18	gravel	70	8	2.25	1,120.99	9
			3	stone	stone	61			273	18	gravel	198	6	.85	615.35	10
					stone	40	55	20	310	15	gravel	358	6	5.00	300.00	11
2	15	cedar	9	wood					546	12				2.20	801.51	12
					stone	60	10	20	320	18	gravel	320	6	1.50	999.57	13
1	22	tamarac	13	cedar	clay	5,418	160	15	260	20	gravel	290	6	2.75	2,965.93	14
			1	wood	earth	40	50	12	80	24	gravel	780	8	2.50	1,310.02	15
1	16	tamarac	3	spruce			180	18	453	14	gravel	235	6	1.50	725.52	16
			1	metal			100	20	425	20	gravel	1,225	8	4.50	1,010.95	17
			4	cedar			200	30	175	18	earth	240	4	.75	500.00	18
			7	wood	earth	275	80	8	60	24	gravel	90	7	1.00	711.87	19
			2	cedar	clay	200			200	12				75	402.12	20
			11	cedar	earth	676	51	10	437	19	gravel	220	5	3.50	1,175.37	21
			1	t'm'r'c			160	24	280	24				1.15	758.45	22
			10	cedar	rock	20	53	10	68	14	gravel	427	8	1.50	513.40	23
1	12	wood	5	wood	earth	20	20	10	190	24	gravel	569	7	1.80	1,300.79	24
			1	tile	earth	460			165	14	gravel	298	8	1.00	851.69	25
			3	stone	rock	7,000								1.00	4,825.17	26
			11	cedar	clay	2,310			460	30	gravel	217	6	3.25	1,599.56	27
			10	cedar			435	25	1,120	18	gravel	330	8	3.50	1,051.05	28
1	Re	p. wood	1	stone	stone	260	25	22	555	20	gravel	418	6	2.60	1,024.19	29
			3	stone	earth	120	180	24	330	24	gravel	353	7	1.50	1,102.50	30
			2	wood	stone	30	21	14	260	14				.80	499.94	31
			10	wood	earth	272	25	12	120	24	gravel	345	7	1.50	1,409.21	32
					stone	274	650	4	311	40	clay	311	30	2.10	500.00	33
			19	cedar	gravel	674			635	16	gravel	532	18	4.10	2,623.87	34
			9	cedar										1.50	809.07	35
					stone	260			90	20	gravel	96	5	.50	1,501.15	36
1	52	wood	2	cedar	clay	2,256	80	20	360	20	gravel	256	6	3.25	2,858.00	37
			6	wood	earth	265	200	20	30	12	gravel	740	6	2.50	1,407.72	38
			39	wood	clay	30	240	5	1,743	12	gravel	725	7	11.50	2,492.90	39
			2	stone			300	20	638	18	gravel	500	10	3.50	767.68	40
									450	12	gravel	100	10	1.25	500.00	41
			2	cedar			200	20	1,620	18				6.25	1,689.20	42
			7	cedar	rock	7	80	20	250	20	gravel	150	7	1.20	950.01	43
							250	15	300	15				1.00	252.10	44
			8	cedar	clay	1,847			1,230	20	gravel	669	6	5.00	3,125.00	45
			2	stone			410	20	320	20	stone	686	6	2.75	1,478.00	46
			9	wood	stone	63	90	12	60	24	gravel	570	7	2.00	1,298.07	47
2	16	cedar	5	pine					273	12	gravel	26	6	1.00	700.10	48
			4	cedar					372	14	gravel	836	6	2.75	1,507.03	49
			9	cedar			60	40	507	18	gravel	187	10	2.25	1,017.25	50
			6	wood			260	12	800	24	gravel	1,686	7	6.00	2,927.65	51
							165	15	165	14	gravel	225	8	.75	300.70	52

DEPARTMENT OF LANDS AND FORESTS ONTARIO,

ANNUAL STATE

NUMBER	TOWNSHIPS	NEW CONSTRUCTION							DITCHED
		Cleared and Stumped		Graded and Shaped		SURFACED			
		Length, rods	Width, feet	Length, rods	Width, feet	Material	Length, rods	Width, feet	Length, rods
1	2	3	4	5	6	7	8	9	10
53	Cameron Township roads	367	40	207	18	gravel	20	6	
54	Cane Township roads	440	30	185	24				30
55	Capreol Township roads	40	35	360	20	stone	40	18	530
56	Carden Township roads								30
57	Cardiff Township roads	40	66	45	20	gravel	30	8	
58	Cardwell Township roads	30	10	80	18				
59	Carling Township roads	80	40	240	16	gravel	300	7	140
60	Carlow Township roads								
61	Carnarvon Township roads	80	24	80	24	gravel	60	8	61
62	Cartier Township roads	160	10	160	10	earth	640	10	200
63	Casey Township roads	760	30	560	26	gravel	160	10	120
64	Casimir Township roads	455	16	455	14				
65	Cavendish Township roads								
66	Chaffey Township roads	80	40	156	20				
67	Chandos Township roads								250
68	Chapleau Township roads	150	20	600	20	sand	220	6	35
69	Chapman Township roads	30	18	160	15	gravel	240	6	85
70	Chisholm Township roads	520	40	170	16				40
71	Christie Township roads								340
72	Clarendon and Miller Township roads	90	40	80	16				312
73	Cockburn Island Township roads								40
74	Cosby Township roads								
75	Creighton Township roads								
76	Crerar Township roads								
77	Croft Township roads								
78	Dalhousie Township roads								
79	Dalton Township roads								260
80	Darling Township roads								
81	Dawson Township roads	80	30	200	24	gravel	90	7	30
82	Denbigh Township roads								
83	Digby Township roads								
84	Dill Township roads	113	50	328	18	earth	20	15	209
85	Dowling Township roads								20
86	Draper Township roads								
	Draper and Macaulay T. L.								
87	Dryden Township roads	80	33	160	33				115
88	Dungannon Township roads								
89	Dunnet Township roads								
90	Dymond Township roads								
91	Eastnor Township roads	126	66	126	28				
92	Elzevir Township roads								
93	Falconbridge Township roads	240	35	500	25				320
94	Falconer Township roads								10
95	Fairbank Township roads								160
96	Faraday Township roads								100
97	Fenwick Township roads	28	40	442	20	gravel	22	7	68
98	Ferguson Township roads								
99	Ferris Township roads	230	40	205	18				
100	Field Township roads								
101	Firstbrooke Township roads								
102	Foley Township roads								
103	Franklin Township roads	500	30	400	18				

OLONIZATION ROADS BRANCH.

ENT, 1920-1921.

BRIDGES		CULVERTS		CUT AND FILL		MAINTENANCE							MILEAGE	EXPENDITURE	NUMBER
						Side-brushed		Graded and Shaped		SURFACED					
Span	Material	Number	Material	Material	Cubic yards	Length, rods	Width, feet	Length, rods	Width, feet	Material	Length, rods	Width, feet			
12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
														$ c.	
		8	cedar					130	18				1.75	1,017.21	53
22	tamarac	4	t'm'r'c	clay	440	240	30	345	24	gravel	130	6	3.00	2,892.41	54
		3	stone	stone	900			640	16				3.15	742.43	55
		3	tile	rock	71	220	18	2,228	18	gravel	393	6	8.00	1,204.25	56
		6	wood			85	30	225	18	gravel	55	5	4.00	600.23	57
		9	wood	earth	100	200	21	370	20	gravel	225	5	1.50	1,200.70	58
		5	cedar	sand	300								1.00	949.49	59
		5	cedar	earth	84			82	18				.27	300.53	60
		1	wood	stone	976	100	12	100	26	gravel	345	8	1.50	1,312.61	61
		1	wood										2.00	200.50	62
				clay	100			720	24	gravel	1,036	6	9.00	5,288.03	63
		2	cedar							gravel	122	6	1.80	578.20	64
Rp	'd cedar	2	cedar			1,240	15	350	12	gravel	93	7	4.00	290.25	65
		4	cedar										.50	500.01	66
		8	cedar	stone	100	326	12	306	14	gravel	271	7	2.50	1,014.05	67
				clay	215								2.00	1,000.00	68
14	cedar	21	wood	rock	205	660	12	640	16	gravel	480	7	3.50	1,940.39	69
		14	cedar	stone	38			565	18	gravel	550	10	4.50	2,971.66	70
10	cedar	13	cedar	earth	20	1,200	14	880	8	gravel	880	6	4.50	1,300.25	71
		3	wood	stone	625	56	20	236	16	gravel	180	5	2.00	901.02	72
						760	12			gravel	225	8	2.50	500.27	73
12	wood	11	wood			545	16	728	14	gravel	285	6	3.50	1,198.99	74
18	cedar	2	cedar	sand	225			200	12	clay	545	12	2.00	385.33	75
11	cedar	5	cedar					286	14	gravel	1,440	6	4.50	1,104.78	76
		3	cedar			60	18	160	14	gravel	160	6	.50	400.35	77
								500	18	gravel	200	10	1.57	302.50	78
		9	wood	rock	10	750	8	2,240	18	gravel	481	6	9.00	1,000.70	79
								100	25	gravel	370	8	1.40	302.81	80
		3	wood	stone	10								.62	549.97	81
				earth	280					gravel	25	7	.25	200.00	82
				earth	40	10	8	47	20	gravel	135	5	.50	301.15	83
													1.40	455.00	84
		2	wood					320	15				1.00	103.25	85
		6	stone	rock	10	200	30	125	18	gravel	625	5	2.00	1,301.20	86
		9	cedar	rock	400	480	20	500	18	gravel	325	5	2.00	2,499.07	
16	cedar	3	cedar					20	12				.75	354.90	87
		5	cedar	stone	1,126	125	20	579	18	gravel	229	7	2.25	1,401.84	88
		4	cedar					403	12				1.26	203.41	89
		1	metal	clay	3,264	130	20	660	24	gravel	1,538	6	5.75	5,110.03	90
19	cedar												.40	498.09	91
		2	metal					368	20	gravel	108	5	1.10	208.80	92
		4	cedar										1.57	614.85	93
10	cedar	2	cedar					275	12				.80	400.00	94
		7	wood			320	26	720	20				2.75	306.25	95
Rp	'd wood	3	cedar	rock	20			320	18	gravel	355	6	2.00	995.13	96
20	cedar	2	cedar	sand	861	500	30	640	16	gravel	466	7	3.50	3,208.84	97
		6	cedar	rock	45	400	30	480	14	gravel	240	6	1.50	497.77	98
		30	cedar					1,210	18	gravel	355	10	5.00	2,773.39	99
		6	cedar					1,260	12	gravel	679	6	4.75	1,899.03	100
								480	24	gravel	393	6	1.50	1,497.76	101
12	pine	6	cedar			640	24	160	16	gravel	560	7	2.00	548.75	102
		9	wood										1.55	500.60	103

DEPARTMENT OF LANDS AND FORESTS ONTARIO,

ANNUAL STATE

NUMBER	TOWNSHIPS	NEW CONSTRUCTION							DITCHED
		Cleared and Graded		Graded and Shaped					
		Length, rods	Width, feet	Length, rods	Width, feet	Material	Length, rods	Width, feet	Length, rods
1	2	3	4	5	6	7	8	9	10
104	Freeman Township roads								
105	Frontenac Trunk road								1,166
106	Galbraith Township roads								260
107	Galway Township roads								
108	Garson Township roads								20
109	Gladstone Township roads	560	50	390	20	gravel	70	6	
110	Glamorgan Township roads								
111	Gordon Township roads								30
112	Gould Township roads	30	66	70	22				
113	Grattan Township roads								
114	Griffith and Matawatchan Twp. roads								
115	Gurd Township roads								
116	Hagar and Loughrin Township roads	289	30	440	14	gravel	160	9	403
117	Hagarty and Richards Township roads	30	60	125	28				
118	Hallam Township roads	170	28	184	22				50
119	Hanmer Township roads	600	33	145	20	sand	300	20	40
120	Harvey Township roads	160	40	610	28				
121	Harris Township roads								424
122	Harvey Township roads								
123	Head, Clara and Maria Township roads								
124	Henwood Township roads								78
125	Hilliard Township roads	320	40						1,105
126	Hilton Township roads								320
127	Himsworth North Township roads	120	30	120	16	gravel	35	7	537
128	Himsworth South Township roads	80	40	80	16	earth	50	6	
129	Hinchinbrooke Township roads								
130	Hodgins and Gaudette Township roads	1,506	40	1,506	24	gravel	35	5	18
131	Horton Township roads								
132	Howe Island Township roads								
133	Hudson Township roads								
134	Hugel Township roads	728	16	300	12				400
135	Humphrey Township roads								30
136	Hungerford Township roads								
137	Huntingdon Township roads								
138	Johnson Township roads								20
139	Kennebec Township roads								40
140	Kearns Township roads								20
141	Kirkpatrick Township roads								
142	Kirkpatrick and McPherson Tp. roads								
143	Korah Township roads	5	30	5	20				129
144	Laird Township roads								
145	L'Amable to Maynooth Trunk road								
146	Laurier Township roads	62	24	132	20				4
147	Lavant Township roads	40	25	40	25				30
148	Laxton Township roads								100
149	Lefroy Township roads								153
150	Limerick Township roads								
151	Lindsay Township roads								50
152	Lorne Township roads	1,283	30	1,300	16				102
153	Loughboro Township roads								100
154	Louise Township roads	40	24	120	20	gravel	80	7	120
155	Lount Township roads								49

COLONIZATION ROADS BRANCH—*Continued*.

MENT, 1921-1922.

BRIDGES			CULVERTS		CUT AND FILL		MAINTENANCE							MILEAGE	EXPENDITURE	NUMBER
							Side-brushed		Graded and Shaped		SURFACED					
Number	Span	Material	Number	Material	Material	Cubic yards	Length, rods	Width, feet	Length, rods	Width, feet	Material	Length, rods	Width, feet			
11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
															$ c.	
			10	metal					250	18	gravel	300	5	1.00	500.07	104
1	12	cedar	17	metal	stone	1,457	48	20	928	18	gravel	783	9	3.00	4,900.00	105
1	10	wood	1	wood			320	10	145	20	gravel	390	6	2.25	962.99	106
			3	cedar			110	10	741	16	gravel	341	7	5.00	606.70	107
1	12	cedar	3	cedar	clay	130	75	30	75	12				.25	150.25	108
									80	20	gravel	260	6	2.75	1,102.49	109
			13	stone	stone	125	970	16	710	16	gravel	113	7	4.00	905.10	110
							80	16	130	28	gravel	728	7	3.00	1,505.76	111
					rock	150								.25	403.50	112
1	10	cedar	4	cedar	stone	50	30	14	1,120	18	gravel	300	9	3.50	1,006.85	113
			17	cedar			600	25	2,300	12	gravel	320	8	8.00	1,200.00	114
			10	cedar	rock	30			126	16	gravel	60	7	.50	300.00	115
			9	cedar	gravel	1,932	640	30	668	12	gravel	375	5	5.50	1,454.43	116
			7	cedar			650	20	1,180	20	gravel	900	8	5.50	2,217.13	117
1	12	wood	3	wood	earth	583			150	24	gravel	140	6	1.20	800.91	118
			4	cedar										2.00	199.75	119
			2	stone	gravel	2,481			180	24	gravel	587	6	4.00	3,593.60	120
			7	cedar	stone	209	160	18	30	28	gravel	1,012	6	4.00	4,609.53	121
			2	metal	stone	25	80	6	1,241	18	gravel	854	6	4.50	1,102.25	122
			2	cedar					205	18	gravel	20	10	.61	457.75	123
			4	cedar	clay	890	30	12	990	20	gravel	774	6	4.00	2,679.16	124
			6	cedar	clay	4,000	180	12	480	24	gravel	419	7	5.00	4,115.54	125
									200	20	gravel	70	5	1.00	349.79	126
			4	cedar			480	20	70	16	gravel	740	7	3.50	1,651.73	127
			6	cedar			300	35	100	18				1.25	655.98	128
			7	cedar					52	16	gravel	957	8	3.00	931.89	129
2	25	cedar	10	wood	earth	8,890								6.00	4,506.19	130
			1	cem'nt			75	35	100	30	gravel	75	12	.50	300.00	131
					stone	10			121	6	g.stone	130	8	.40	302.20	132
			4	cedar	clay	853			2,380	26	gravel	730	6	9.00	2,707.99	133
1	14	pine	19	cedar	earth	50			1,243	14	gravel	605	6	9.00	2,547.41	134
			10	stone	stone	240	280	20	375	18	gravel	341	7	1.25	934.60	135
					stone	104			301	16	gravel	367	6	1.15	851.93	136
			1	tile					170	20	gravel	211	14	.75	495.61	137
					stone	125	320	50	120	24	gravel	120	6	1.30	453.33	138
			4	metal	earth	200			170	18	gravel	766	8	3.00	904.76	139
1	12	tamarac	6	cedar	clay	3,141			1,950	24	gravel	1,541	6	9.00	5,778.14	140
2	10	wood	23	wood	stone	52			880	16	gravel	330	6	3.50	2,320.83	141
			7	wood					584	14	gravel	1,285	6	6.75	1,836.95	142
					earth	730								.10	510.90	143
			1	wood			30	20	190	22	gravel	420	6	1.31	800.40	144
			9	cedar	earth	2,988	100	20	1,649	18	gravel	794	7	6.25	3,014.29	145
1	10	cedar	2	stone	earth	560								.50	597.02	146
			8	cedar	rock	10	30	30	1,350	20	gravel	650	8	4.50	1,409.99	147
			2	stone	stone	183	100	16	1,960	18	gravel	633	6	7.00	1,582.14	148
			3	tile	stone	84			120	28	gravel	475	6	1.50	949.23	149
									103	16	gravel	62	9	.32	299.15	150
									10	18	gravel	450	5	1.40	775.20	151
			29	wood	earth	356	30	12	60	24	gravel	80	8	4.27	1,300.77	152
			7	stone	stone	50	5	24	46	18	gravel	212	9	1.75	853.25	153
1	Rp	'd wood	4	wood										.40	698.69	154
			6	cedar	earth	40	591	25	369	16	gravel	105	5	1.85	552.15	155

DEPARTMENT OF LANDS AND FORESTS ONTARIO,

ANNUAL STATE

NUMBER	TOWNSHIP	NEW CONSTRUCTION							DITCHED
		Cleared and Graded		Graded and Shaped		SURFACED			
		Length, rods	Width feet	Length, rods	Width, feet	Material	Length, rods	Width, feet	Length, rods
1	2	3	4	5	6	7	8	9	10
156	Lumsden Township roads	210	30	310	9				210
157	Lutterworth Township roads								
158	Lyell Township roads								
159	Macaulay Township roads								
160	Machar Township roads								
161	Madoc Township roads								
162	Mara Township roads								
163	Martland Township roads								
164	Martland and Scollard Township roads								15
165	Mason Township roads								
166	Mattawan Township roads								
167	May Township roads								
168	May and Harrow Township road								
169	Mayo Township roads								
170	McDougall Township roads								
171	McDonald Township roads								
172	McKellar Township roads								
173	McKenzie Township roads								
174	McKim Township roads								360
175	McLean Township roads								
176	McMurrick Township roads	280	45	127	15	gravel	100	6	100
177	McNabb Township roads								
178	McPherson Township roads	300	16	130	14				
179	Medonte Township roads			89	20				53
180	Medora Township roads								
181	Meredith Township roads								
182	Methuen Township roads								
183	Merritt Township roads	60	32	160	20				
184	Mills Township roads (Manitoulin)								20
185	Mills Township Roads (Parry Sound)	499	60	400	30				
186	Minden Township roads								
187	Monmouth Township roads								
188	Monteith Township roads	960	40	640	16				
189	Monteagle and Herschel Township roads	180	30	180	16				
190	Morgan Township roads			255	20				40
191	Morrison Township roads								
192	Murchison Township roads								
193	Muskoka Township roads								
194	Nairn Township roads					gravel	30	7	
195	Nipissing Township roads	280	24	280	14				
196	Oakley Township roads								
197	Olden Township roads								
198	Orillia Township roads								
198a	Orillia and Matchedash T. L.								
199	Oro Township roads								26
200	Pakenham Township roads								
201	Palmerston Township roads	70	40	30	16	gravel	10	8	
202	Papineau Township roads								
203	Parkinson Township roads								
204	Patterson Township roads								
205	Patton Township roads								40
206	Pembroke Township roads								

COLONIZATION ROADS BRANCH.

MENT, 1921-1922.

BRIDGES			CULVERTS		CUT AND FILL		MAINTENANCE									
							Side-brushed		Graded and Shaped		SURFACED					
Number	Span	Material	Number	Material	Material	Cubic Yards	Length rods	Width, feet	Length, rods	Width, feet	Material	Length, rods	Width, feet	MILEAGE	EXPENDITURE	NUMBER
11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
			1	cedar										1.00	102.00	156
			7	stone	stone	118	23	20	258	20	gravel	183	6	2.00	658.90	157
			3	cedar					270	18	gravel	50	12	.85	504.10	158
			1	stone	earth	270					gravel	4	5	.02	200.00	159
			8	cedar	stone	5	424	24	567	14	gravel	330	6	2.00	1,524.99	160
			2	steel					120	18	gravel	108	7	.37	248.90	161
					stone	1,409			51	22				.20	997.55	162
			4	wood					182	12	gravel	390	6	1.80	799.91	163
			5	wood					20	14	gravel	35	6	.12	611.71	164
			7	cedar			101	16	260	12				.82	703.85	165
			13	cedar					285	18	gravel	85	10	.90	800.40	166
					earth	444			120	20	gravel	250	6	.80	801.25	167
											gravel	270	6	.85	300.45	168
			9	cedar					178	20	gravel	138	6	.57	500.26	169
			7	cedar	stone	50	560	24	80	14	gravel	80	7	1.75	303.11	170
1	12	cedar			earth	75			80	24	gravel	205	5	.63	451.93	171
			7	cedar	rock	25			106	16	gravel	480	7	1.50	800.00	172
			3	cedar			160	16	400	16	gravel	320	6	1.25	499.75	173
			10	conc'te			150	11	360	22	clay	150	7	1.13	450.88	174
			5	cedar	rock	85			125	20	gravel	250	5	.80	850.00	175
			5	cedar	sand	600								.90	500.00	176
									400	18				1.25	307.25	177
3	12	cedar	25	cedar			150	16	3,088	12	gravel	240	6	12.00	4,008.68	178
			7	metal	earth	886			197	18	c.stone	258	6	1.40	1,504.15	179
			1	stone	stone	300			45	20	gravel	45	5	.12	402.50	180
			2	wood					100	24	gravel	140	6	.50	299.90	181
											c.stone	135	6	.41	300.00	182
1	18	wood	15	metal	earth	300	295	12	320	20	gravel	250	7	1.50	1,009.07	183
			3	metal	stone	800	40	14	30	24	gravel	415	9	1.35	1,401.59	184
			3	cedar	earth	60	84	30	160	16				1.75	749.30	185
			3	wood	stone	40	40	19	650	18	gravel	45	6	2.25	301.35	186
			6	stone	stone	38	45	30	380	18	gravel	57	6	1.25	503.83	187
2	22	cedar	12	cedar	earth	1,000								3.00	2,969.62	188
			5	cedar	stone	422			197	20	gravel	199	6	1.20	896.05	189
			2	cedar	stone	250					gravel	90	16	1.08	303.75	190
									500	20	gravel	500	5	1.57	500.15	191
			5	cedar					320	18				1.00	505.90	192
			11	cedar	rock	14	550	40	380	18	gravel	140	5	1.75	1,000.00	193
			5	wood	stone	220	200	12	140	16				.75	396.70	194
			6	cedar	stone	380	30	20	160	16	gravel	250	7	2.10	1,554.21	195
					stone	380								.10	500.00	196
			1	stone	stone	198	15	15	24	16	gravel	160	9	.50	300.65	197
			1	conc'te					290	18	c.stone	245	7	1.00	601.60	198
					stone	122			97	18	gravel	101	7	.50	504.25	198a
			1	wood	stone	434			125	18	gravel	329	7	1.25	904.62	199
											gravel	160	8	.50	100.00	200
			1	stone	stone	1,037					gravel	753	10	2.50	1,426.15	201
			11	cedar					1,117	18	gravel	130	6	4.00	1,545.04	202
1	16	wood	2	wood	earth	1,348			300	20	gravel	444	6	1.60	1,399.90	203
			3	stone	stone	600	30	20	20	18				.20	294.63	204
1	12	wood	6	wood	earth	360	100	30	250	22	gravel	304	6	1.25	999.61	205
											gravel	405	10	1.41	407.11	206

DEPARTMENT OF LANDS AND FORESTS, ONTARIO,

ANNUAL STATE

NUMBER	TOWNSHIPS	NEW CONSTRUCTION							RE-DITCHED
		Cleared and Stumped		Graded and Shaped		SURFACED			
		Length rods	Width, feet	Length, rods	Width, feet	Material	Length, rods	Width, feet	Length, rods
1	2	3	4	5	6	7	8	9	27
207	Petewawa Township roads								
208	Plummer and Plummer Add'l Twp. rds.	200	60	230	20	gravel	60	6	60
209	Pr nce Township roads								80
210	Radcliffe Township roads								
211	Ragian Township roads								
212	Rama Township roads								
213	Ramsay Township roads								
214	Ratter Township roads								
215	Rayside Township roads								320
216	Robinson Township roads	320	28	270	20	gravel	60	7	80
217	Rolph Township roads								
218	Rose Township roads	160	66	120	30				
219	Ross Township roads			150	25				
220	Ryde Township roads								
221	Ryerson Township roads								
222	Sabine Township roads								
223	Salter Township roads	160	20	320	20				
224	Sandfield Township roads								
225	Sebastopol Township roads								
226	Shakespeare Township roads								
227	Shedden Township roads	380	60	210	22				
228	Sheffield Township roads								
229	Sheguiandah Township roads								35
230	Sherbrooke Township roads								
231	Sherwood, Jones and Burns Twp. roads								
232	Scollard Township roads								
233	Sinclair Township roads	195	30	58	18				
234	Snowdon Township roads								40
235	Somerville Township roads								
236	Spence Township roads	25	40	30	14	gravel	130	7	50
237	Springer Township roads								
238	Stafford Township roads								
239	Stanhope Township roads	80	66	80	18	gravel	80	6	160
240	Stephenson Township roads								
241	St. Edmunds Township roads			15	24	gravel	73	7	
242	Stisted Township roads								
243	Storrington Township roads								
244	Striker Township roads	320	20	175	18	gravel	40	6	50
245	Strong Township roads	260	40	180	16	gravel	60	6	50
246	Summidale Township roads								25
247	Tarbutt and Tarbutt Add'l Twp. roads								180
248	Tarentorus Township roads	73	20	149	10	gravel	118	6	
249	Tay Township roads								151
250	Tehkummah Township roads	50	40	50	26				
251	Thessalon Township roads								80
252	Thompson Township roads	80	60	80	20	gravel	20	6	85
253	Tiny Township roads								286
254	Tudor and Cashel Township roads								
255	VanKoughnet Township roads	886	30	850	21				60
256	Verulam Township roads								
257	Vespra Township roads								
258	Victoria Township roads								40

COLONIZATION ROADS—*Continued.*

MENT, 1920-1921.

BRIDGES			CULVERTS		CUT AND FILL		MAINTENANCE									
							Side-brushed		Graded and Shaped		SURFACED					
Number	Span	Material	Number	Material	Material	Cubic yards	Length, rods	Width, feet	Length, rods	Width, feet	Material	Length, rods	Width, feet	MILEAGE	EXPENDITURE	NUMBER
11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
					stone	900			275	18	gravel	270	8	1.10	$ c. 409.75	207
			6	wood	earth	30			120	24	gravel	169	5	1.25	1,000.00	208
			1	cedar	sand	2,003	35	15	36	24	gravel	57	7	.25	499.74	209
			10	cedar			200	45	1,600	14				5.00	1,020.90	210
			2	cedar			175	15	1,645	16	gravel	300	12	5.25	1,052.12	211
			1	steel	sand	274			179	24	gravel	294	6	1.00	1,500.17	212
									700	18	gravel	600	8	2.75	800.40	213
			3	cedar					1,242	14	gravel	463	6	4.00	1,400.80	214
			5	wood			320	30	310	12				1.00	500.18	215
2	11	wood	2	wood	stone	125					gravel	140	7	2.25	1,573.82	216
							150	10	300	14				1.00	200.30	217
			2	wood										.50	303.63	218
			1	cedar	earth	1,400								1.40	837.37	219
			4	cedar			1,100	40	450	18	gravel	465	5	3.40	809.81	220
1	14	wood	13	cedar					160	14	gravel	160	6	.50	300.00	221
			5	cedar					300	18	gravel	20	10	1.00	518.50	222
1	12	timber	2	wood	stone	510			80	24				1.25	600.20	223
			3	stone	stone	1,560	460	24	270	24	gravel	395	7	2.00	1,447.50	224
			5	cedar			75	14	1,270	12				4.00	839.75	225
			2	wood	earth	280			80	22	gravel	310	6	1.00	700.50	226
			5	wood	earth	350								1.25	600.00	227
			1	metal	earth	125			10	14	gravel	18	8	1.00	100.00	228
			1	wood	stone	230	80	12	150	20	gravel	305	7	1.00	800.55	229
			9	cedar			300	40	350	18				1.10	421.11	230
							820	14	1,215	14				4.00	1,303.90	231
			3	wood					234	12	gravel	120	6	.75	400.01	232
														.60	500.00	233
			2	wood	rock	44	80	20	270	16	gravel	128	6	2.00	500.00	234
							65	20	130	20	gravel	306	5	1.00	500.00	235
1	12	tamarac	5	cedar	stone	6	80	40			gravel	640	6	2.50	618.00	236
			8	cedar	stone	240	595	16	330	14	gravel	460	6	5.00	3,103.25	237
			2	cedar	earth	200			198	30	gravel	228	8	1.00	595.46	238
			6	stone	rock	25			75	18	gravel	95	6	2.25	527.82	239
			2	cedar					150	20	gravel	300	5	1.00	499.75	240
					stone	235								.25	698.75	241
			2	stone	stone	1,100			60	18	gravel	65	5	.25	750.92	242
			5	metal	rock	20			8	16	gravel	326	8	1.10	750.10	243
			6	wood	earth	400								2.00	710.95	244
			9	cedar	rock	80								1.10	745.31	245
					clay	2,500					gravel	272	7	1.00	400.10	246
			7	tile			250	20			gravel	50	5	.80	351.25	247
					stone	117								.40	300.00	248
			1	wood	clay	3,142								.40	1,010.00	249
1	12	wood	5	wood	earth	230	580	12	200	24	gravel	545	7	2.50	1,204.24	250
					stone	80			295	22	gravel	205	6	1.00	498.57	251
					earth	100			620	20	gravel	340	5	2.25	1,011.08	252
			1	metal	rock	86			42	10	gravel	348	7	1.25	734.30	253
			5	cedar	stone	240	1,280	30	30	14	gravel	250	6	4.00	641.95	254
1	32	R'pd	8	cedar	earth	1,955					gravel	309	7	4.50	2,960.24	255
					stone	615	28	12	12	20				.25	300.20	256
			1	conc'te	clay	680			59	16	gravel	118	7	.50	511.10	257
1	Rp'	d wood	7	wood	earth	35			550	20	gravel	280	6	1.75	550.37	258

DEPARTMENT OF LANDS AND FORESTS, ONTARIO,

ANNUAL STATE

NUMBER	TOWNSHIP	NEW CONSTRUCTION							DITCHED
		Cleared and Graded		Graded and Shaped		SURFACED			
		Length, rods	Width, feet	Length, rods	Width, feet	Material	Length, rods	Width, feet	Length, rods
1	2	3	4	5	6	7	8	9	10
259	Wallbridge Township roads			440	18				24
260	Waters Township roads								12
261	Watt Township roads	200	20	200	16				
262	Wells Township roads	80	40	80	22	gravel	60	6	
263	Westmeath Township roads								
264	Widdifield Township roads	1,000	40	170	18	gravel	30	10	
265	Wilberforce Township roads								220
266	Wilson Township roads								80
267	Wollaston Township roads								
268	Wylie Township roads								
	Total	21,314		21,647			4,061		17,488

COLONIZATION ROADS BRANCH.

MENT, 1921-1922.

BRIDGES			CULVERTS		CUT AND FILL		MAINTENANCE							MILEAGE	EXPENDITURE	NUMBER
							Side-brushed		Graded and shaped		SURFACED					
Number	Span	Material	Number	Material	Material	Cubic Yards	Length, rods	Width, feet	Length, rods	Width, feet	Material	Length, rods	Width, feet			
11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
2	12	cedar	13	cedar	stone	380								1.50	942.12	259
1	125	cedar	2	cedar	clay	225	6	33			gravel	420	9	1.50	550.50	260
			4	stone	stone	400								.62	499.99	261
			5	wood	gravel	20					gravel	80	5	.50	754.57	262
			2	cem'nt							gravel	800	10	2.50	800.04	263
			21	cedar			110	20	1,364	18	gravel	615		9.00	3,227.85	264
			6	cedar	rock	417	600	20	1,680	14	gravel	1,200	8	7.50	2,196.12	265
1	40	cedar	1	cedar	rock	3	168	30	280	16	gravel	48	6	1.00	505.77	266
			1	cedar							c.stone	127	7	.40	299.50	267
							500	16	700	14				2.20	501.05	268
62			1,284			100,566	31,825		100,263			78,316		615.29	$293,540.26	

SCHEDULE SHOWING THE AMOUNT OF WORK OF ROAD CONSTRUCTION,

NUMBER	TOWNSHIPS	CLEARED AND STUMPED		GRADED		SURFACED		
		Length, rods	Width, feet	Length, rods	Width, feet	Material	Length, rods	Width, feet
1	2	3	4	5	6	7	8	9
1	Admaston By-law No. 249			950	20	gravel	1,300	8
2	Albermarle By-law No. 590	20	12			gravel	780	5
3	Alberton By-law No. "H"	235	35	182	40	gravel	466	5
4	Armstrong By-law No. 8			1,220	28	gravel	255	6
5	Assiginack By-law No. 440	240	24	1,180	24	gravel	840	7
6	Atwood By-law No. 112	645	66	196	30	gravel	497	5
7	Bagot and Blythfield By-law No. 339	300	30	1,075	15	gravel	1,150	8
8	Balfour By-law No. 67	470	15	1,710	12	gravel	4,735	12
9	Belmont and Methuen By-law No. 622			50	14	c.stone	796	6
10	Blue By-law No. 55	490	66	600	28	gravel	160	8
11	Billings By-law No. 258			430	24	gravel	530	7
12	Brethour By-law No. 19			800	26	gravel	1,654	6
13	Brougham By-law No. 717			1,125	14	gravel	170	8
14	Brudenell and Lyndoch By-law No. 268	700	14	1,870	14	gravel	130	8
15	Bucke By-law No. 240					gravel	350	6
16	Burleigh and Anstruther By-law No. 1			100	14	gravel	288	6
17	Caldwell By-law No. 291	247	16	507	14	gravel	1,469	6
18	Calvert By-law No. 27	1,813	66	4,825	24	cinders	804	12
19	Calvert By-law No. 12	72	24	127	24	cinders	127	8
20	Carling By-law No. 128	40	35	65	16	gravel	720	7
21	Carlow By-law No. 126			1,463	14	gravel	312	7
22	Carnarvon By-law No. 343			495	24	gravel	604	7
23	Carnarvon By-law No. 333			460	24	gravel	850	7
24	Casey By-law No. 62	360	40	3,000	36	gravel	280	6
25	Casimir, Jennings and Appleby By-law No. 93	364	16	2,535	12	gravel	2,161	6
26	Chamberlain By-law No. 72			92	16	gravel	302	8
27	Chandos By-law No. 45	39	20	807	14	gravel	480	7
28	Chandos By-law No. 58			1,240	14	gravel	330	6
29	Chapman By-law No. 8			184	16	gravel	649	6
30	Chapple By-law No. 280	2,469	66	1,540	28	gravel	2,484	5
31	Chisholm By-law No. 111			95	18	gravel	20	10
32	Coleman By-law No. 276					gravel	180	6
33	Dilke By-law No. 100	40	20	448	28	gravel	356	5
34	Draper By-law No. 401	100	30	1,700	18	gravel	584	5
35	Drury, Denison and Graham By-law No. 200	660	10	3,225	14	gravel	3,765	7
36	Dymond By-law No. 206	100	30	1,475	22	gravel	1,336	6
37	Dysart By-law No. 648	2,215	16	3,171	20	gravel	3,828	8
38	Dungannon By-law No. 91	80	10	215	18	gravel	40	5
39	Eastnor By-law No. 44			70	15	gravel	1,003	5
40	Eldon By-law No. 520	35	10	1,297	20	gravel	1,214	6
41	Elzevir By-law No. 55A			107	14	gravel	395	6
42	Emo By-law No. 250	260	40	381	28	gravel	2,226	5
43	Faraday By-law No. 121			60	20	gravel	438	6
44	Ferris By-law No. 108			880	16	gravel	300	8
45	Front of Leeds and Lansdowne By-law No. 762			920	18	c.stone	2,380	8
46	Glackmeyer By-law No. 13	304	25	6,877	24	clay	3,375	8
47	Gillies By-law No. 1	1,420	40	1,390	18	gravel	345	7
48	Gordon and Allan By-law No. 167	80	12	320	24	gravel	1,318	8
49	Grattan By-law No. 284	100	20	2,420	15	gravel	930	8
50	Hagarty and Richards By-law No. 116	475	25	1,900	14	gravel	850	7
51	Hanmer By-law No. 107			2,880	16			
52	Harley By-law No. 271			3,370	24	gravel	788	16
53	Harvey By-law No. 367	730	20	1,461	24	gravel	1,175	7
54	Hilliard By-law No. 129	80	20	420	25	gravel	2,116	6
55	Hilton By-law No. 411	110	16			gravel	656	6

COLONIZATION ROADS BRANCH, MUNICIPAL BY-LAWS, 1921.

DITCHED	CUT OR FILL		BRIDGES			CULVERTS		NEW ROAD MILEAGE	OLD ROAD MILEAGE	GOVERNMENT EXPENDITURE	NUMBER
Length, rods	Material	Amount in Cu. yards	Number	Span, feet	Material	Number	Material				
10	11	12	13	14	15	16	17	18	19	20	21
										$ c.	
									5.00	999.87	1
	rock	10							2.50	687.32	2
	earth	108	1	12	plank	4	metal	.25	2.00	1,078.79	3
						5	cedar		4.25	500.00	4
155	earth	360	1	repaired		7	wood		4.00	1,500,00	5
	clay	264				2	metal	1.50	2.00	1,277.50	6
						7	metal		4.00	924.20	7
2,273			4	re-floored		58	cedar		14.50	1,909.45	8
									3.00	598.92	9
136	earth	318				6	wood	1.25	1.00	1,132.50	10
30	earth	37	1	re-floored		7	wood		2.00	700.00	11
	clay	600	1	re-floored		7	tamarac		7.00	2,216.67	12
									4 00	500.00	13
						11	cedar	.06	6.00	1,000.00	14
									1.10	499.68	15
	stone	13				1	cedar		1.00	250.00	16
156						14	plank		5.00	1,495.29	17
840	clay	10,209	1	14	wood	19	wood	9.00	11.50	7,421.25	18
68						6	wood		.50	953.00	19
						2	concrete	.38	1.60	500.00	20
						14	cedar		5.00	750.00	21
	stone	45	2	re-floored		5	metal		3.00	700.00	22
	earth	415				2	wood		3.00	700.00	23
380	clay	180	2	16	Rep.	5	tamarac	1.75	8.50	1,058.95	24
5,102						46	wood	.25	10.00	1,700.00	25
40	clay	379	2	25	wood	32	M.& W.		1.00	527.42	26
116	stone	134				1	cedar	.12	4.00	650.00	27
180	earth	6				4	cedar		8.00	400.00	28
						10	cedar		2.50	500.00	29
400	clay	1,711	1	11	wood	36	wood	7.00	8.00	7,500.00	30
50						2	cedar		.30	200.00	31
	clay	50				1	cedar		.60	271.21	32
110	clay	30				3	cedar		2.00	552.67	33
	stone	161				52	cedar		6.00	1,000.00	34
1,890	clay	265	2	16	cedar	15	cedar		12.50	2,359.46	35
40	clay	720				10	cedar		8.00	2,494.30	36
240	clay	950				32	wood	.75	22.00	4,999.69	37
	stone	132				3	cedar		1.00	300.00	38
			1	22	cedar	12	cedar		3.50	1,000.00	39
	rock	27				6	tile		7.00	1,994.12	40
35									1.40	500.00	41
180	clay	170				7	wood		8.00	3,024.57	42
	stone	943				1	concrete		1.50	450.00	43
40						19	cedar		3.00	1,000.00	44
									7.05	1,320.00	45
589	clay	494	3	12	wood	23	wood	1.00	22.00	9,984 52	46
290	clay	1,730				37	wood	1.25	5.00	1,000.00	47
						3	metal		4.50	1,240.14	48
						11	tile		8.00	1,500.00	49
						4	cedar		7.00	1,000.00	50
						2	cedar		9.00	722.95	51
	stone	20				14	cedar		11.75	1,484.70	52
	stone	166				5	concrete		8.00	1,000.00	53
180	clay	1,395				12	cedar		7.75	2,745.51	54
130	stone	90	2	repaired		4	wood		2.25	675.00	55

SCHEDULE SHOWING THE AMOUNT OF WORK OF ROAD CONSTRUCTION

Number	TOWNSHIP	CLEARED AND STUMPED		GRADED		SURFACED		
		Length, rods	Width, feet	Length, rods	Width, feet	Material	Length, rods	Width, feet
1	2	3	4	5	6	7	8	9
56	Himsworth South By-law No. 71B			320	18	gravel	180	6
57	Howland By-law No. 169	40	12	320	24	gravel	815	7
58	Hudson By-law No. 84			800	24	gravel	230	6
59	Hungerford By-law No. 247			87	14	gravel	521	6
60	Humphrey By-law No. 371	160	20	160	18	gravel	160	7
61	Humphrey By-law No. 361			40	16	gravel	70	7
62	Huntingdon By-law No. 430			382	14	gravel	450	7
63	Jocelyn By-law No. 310	170	8			gravel	595	6
64	Johnson By-law No. A105	80	20	240	30	gravel	470	6
65	Kerns By-law No. 182			60	20	gravel	1,540	6
66	Korah By-law No. 213	666	16	4,210	24	gravel	3,008	7
67	Korah By-law No. 194	341	16	2,000	20	slag	898	7
68	Laird By-law No. 133			350	24	gravel	1,055	5
69	Lavalle By-law No. 216	1,277	66	1,555	20	gravel	1,358	5
70	Limerick By-law No. 3			105	16	gravel	309	5
71	Lindsay By-law No. 322	150	12			gravel	1,055	5
72	Macaulay By-law No. 80	50	20	730	20	gravel	380	5
73	Machar By-law No. 574	260	20	255	20	gravel	233	1
74	Madoc By-law No. 50			476	18	gravel	775	7
75	Mara By-law No. 580	98	7	943	26	c.stone	757	6
76	Marmora and Lake By-law No. 552			172	18	gravel	408	7
77	Martland By-law No. 145	653	8	729	12	gravel	695	6
78	Matchedash By-law No. 209			386	16	gravel	545	7
79	Mayo By-law No. 345			208	18	gravel	133	7
80	McDonald, Meredith and Aberdeen Additional By-law No. 152					gravel	1,055	6
81	McDougall By-law No. 176	20	40	4,332	15	gravel	2,268	8
82	McLean By-law No. 456			70	20	gravel	70	5
83	Medora and Wood By-law No. 354	900	10	980	18	gravel	196	5
84	Monck By-law No. 476			2,200	18	gravel	687	5
85	Monteagle and Herschel By-law No. 506			504	20	gravel	305	7
86	Morley By-law No. 218	1,360	66	854	30	gravel	970	5
87	Muskoka By-law No. 296	30	30	2,060	18	gravel	625	5
88	Nairn By-law No. 120	40	12	60	24	gravel	185	7
89	Neebing By-law No. 395	1,235	40	1,800	24	shale	740	7
90	Neelon and Garson By-law No. 148			100	24	gravel	868	8
91	O'Connor By-law No. 84	1,419	40	1,654	24	gravel	172	7
92	Olden By-law No. 60B	75	8	2,318	16	gravel	830	8
93	Oliver By-law No. 192	740	15	910	24	shale	910	7
94	Oro By-law No. 459			172	18	gravel	845	6
95	Paipoonge By-law No. 176	2,400	20	2,920	20	gravel	2,520	7
96	Perry By-law No. 159	110	40	150	20	gravel	130	7
97	Perry By-law No. 152			155	15	gravel	155	6
98	Plummer Additional By-law No. 171	40	8	440	20	gravel	1,548	6
99	Prince By-law No. 84	92	10	400	20	gravel	190	7
100	Rama By-law No. 390			236	24	gravel	388	6
101	Rear of Yonge and Escott By-law No. 596			300	16	stone	285	9
102	Ryerson By-law No. 457	40	33	640	20	gravel	80	7
103	Sandfield By-law No. 251			510	24	gravel	255	7
104	Sebastopol By-law No. 303	150	15	600	12			
105	Sheffield By-law No. 659			275	16	gravel	1,341	8
106	Sherwood Jones and By-law No. 20	1,800	12	2,525	18			
107	Shuniah By-law No. 456	1,440	20	7,610	18	gravel	2,221	7
108	Somerville By-law No. 730	98	20	538	18	gravel	1,058	6
109	South Crosby By-law No. 884			275	20	stone	775	8

COLONIZATION ROADS BRANCH, MUNICIPAL BY-LAWS, 1921.—*Continued.*

DITCHED	CUT OR FILL		BRIDGES			CULVERTS		NEW ROAD MILEAGE	OLD ROAD MILEAGE	GOVERNMENT EXPENDITURE	NUMBER
Length, rods	Material	Amount in cubic yards	Number	Span, feet	Material	Number	Material				
10	11	12	13	14	15	16	16				
						4	cedar		1.00	250.00	56
34	stone	270				7	wood		2.75	1,100.00	57
70	stone	40				10	cedar		3.40	600.00	58
						2	cedar		2.00	696.65	59
	earth	140				2	cedar		.50	500.00	60
	rock	2							.25	225.00	61
									1.75	300.00	62
114	earth	200	2	15	wood				2.00	600.00	63
100	stone	30				5	wood		1.50	449.81	64
	clay	740	4	33	cedar	11	cedar		5.00	2,393.61	65
1,115	earth	2,390	3	repaired		11	metal	.25	15.00	3,707.50	66
35	rock	3	2	repaired		2	cedar		13.00	3,471.93	67
	stone	100							3.50	1,147.77	68
217	clay	1,127				14	wood	2.25	6.00	3,112.50	69
	earth	135				1	concrete		1.00	400.00	70
									3.50	1,250.00	71
	earth	375				30	cedar		2.50	750.00	72
	stone	135				5	cedar	.30	1.00	499.75	73
	earth	569				12	metal		2.50	786.05	74
			1	20	concrete				3.00	1,491.70	75
200	earth	624				6	metal		1.50	749.66	76
692			1	16	wood	16	wood		5.00	1,024.57	77
						3	metal		2.75	792.31	78
	stone	803				6	cedar		1.00	400.00	79
20									3.50	799.92	80
40	earth	240				31	cedar		14.00	3,200.00	81
						2	cedar		.25	100.00	82
95	earth	550				29	wood		3.75	1,350.00	83
	earth	950				45	cedar		7.00	2,000.00	84
	stone	580				9	cedar		2.00	600.00	85
102						12	wood	4.50	3.00	2,900.45	86
7	earth	571				28	wood		8.00	1,000.00	87
						2	metal		.75	217.46	88
560	earth	1,900	4	22	cedar	14	cedar	3.25	5.25	5,050.00	89
160			1	10	cedar	6	cedar		3.00	1,250.00	90
20	earth	1,400	1	10	wood	33	wood	.90	7.50	1,992.94	91
160						19	metal		7.25	882.25	92
460						9	cedar		4.50	1,700.00	93
	earth	822				1	concrete		3.00	1,000.00	94
442	gravel	550	1	20	wood	58	wood	2.25	11.75	5,495.96	95
60	stone	100				13	metal	.25	.25	500.00	96
									.50	249.62	97
10			1	12	wood	5	wood		5.00	1,200.00	98
493	earth	738				19	cedar		3.25	900.00	99
									1.25	649.21	100
						3	tile		1.00	600.00	101
						2	cedar	.25	2.00	333.50	102
									1.75	400.00	103
						4	metal		2.00	265.00	104
						9	metal		4.50	898.96	105
						2	wood		8.00	800.00	106
125	earth	600	5	16	cedar	25	wood	2.00	19.00	4,450.00	107
160	stone	835				3	concrete		4.00	12,00.00	108
									2.50	749.75	109

SCHEDULE SHOWING THE AMOUNT OF WORK OF ROAD CONSTRUCTION,

NUMBER	TOWNSHIPS	CLEARED AND STUMPED		GRADED		SURFACED		
		Length, rods	Width, feet	Length, rods	Width, feet	Material	Length, rods	Width, feet
1	2	3	4	5	6	7	8	9
110	Springer By-law No. 315			2,560	14	gravel	579	6
111	Stafford By-law No. 706			1,146	30	gravel	1,034	8
112	Stanhope By-law No. 365			2,378	18	gravel	185	8
113	St. Edmunds By-law No. 225	1,100	20	50	24	gravel	562	6
114	St. Joseph By-law No. 448	215	16	110	24	gravel	1,644	5
115	Stephenson By-law No. 524	1,530	16	2,000	18	gravel	865	5
116	Tarbutt and Tarbutt Additional By-law No. 29.	10	10	310	22	gravel	714	6
117	Tarentorus By-law No. 209	1,579	20	640	16	gravel	1,605	7
118	Thessalon By-law No.11			250	20	gravel	285	6
119	Thompson By-law No. 122	80	60	75	22			
120	Tisdale By-law No. 230					stone	740	8
121	Tudor and Cashel By-law No. 5	818	20	183	16	stone	494	6
122	Vespra By-law No. 641			1,284	18	gravel	1,735	6
123	Westmeath By-law No. 264			90	18	gravel	1,076	5
124	Whitney By-law No. 82					gravel	956	10
125	Widdifield By-law No. 311	60	40	880	18	gravel	541	10
126	Wollaston By-law No. 4	42	20	503	18	gravel	395	6
127	Worthington By-law No. 105	14	766	414	28	gravel	149	5
	Total	36,808		126,899			107,162	

COLONIZATION ROADS BRANCH, MUNICIPAL BY-LAWS, 1921.

DITCHED	CUT AND FILL		BRIDGES			CULVERTS		NEW ROAD MILEAGE	OLD ROAD MILEAGE	GOVERNMENT EXPENDITURES	NUMBER
Length, rods	Material	Amount in Cu. yards	Number	Span, feet	Material	Number	Material				
10	11	12	13	14	15	16	17	18	19	20	21
						3	wood		9.00	784.87	110
	earth	2,576				5	wood		5.25	950.06	111
						25	wood		8.00	500.00	112
10						2	cedar		4.00	600.00	113
375	stone	100				3	wood		5.50	1,650.00	114
	rock	2,430	10	14	wood	42	wood		8.00	2,093.75	115
10						2	wood		3.00	500.00	116
366	earth	3,374				12	metal	.50	11.00	3,000.00	117
	earth	150	1	12	concrete	3	metal		1.00	425.00	118
	stone	60				1	wood	.25		100.00	119
									2.30	2,362.80	120
	stone	71				13	cedar		3.25	746.36	121
	clay	5,402				3	concrete		7.00	1,800.00	122
									4.00	1,700.00	123
						6	metal		3.00	2,820.72	124
35	rock	735				16	cedar		3.00	1,500.00	125
	stone	90				3	cedar		2.50	989.44	126
						2	wood	.50	1.00	747.62	127
19,937		54,639	61			1,260		42.01	605.75	176,154.04	

STATEMENT OF COLONIZATION ROADS BRANCH MACHINERY AND ROAD OVERSEER, BY-LAWS 1921.

No.	Township	Service	Government Expenditure
1	Chapple By-Law No. 298	Machinery—8 steel road drags; 4 drag scrapers	$ 98.36
2	Harvey By-Law No. 370	Machinery—2 Boss light graders; tile; gravel	154.97
3	Lavallee By-Law No. 224	Machinery—6 steel road drags	55.22
4	Lindsay By-Law No. 323	Machinery—1 stone crusher	675.00
5	Medora and Wood By-Law No. 368	Machinery—1 steam traction engine; 1 rock crusher with screens; 2 road drags; 16 iron culverts; 1 wood water tank with pumps and hose; timber	889.69
6	Rama By-Law No. 388	Machinery—1 traction engine; 1 tank mounted with pump	431.25
7	Stephenson By-Law No. 529	Machinery—lumber; coal; gravel; cement; explosives; tools	249.03
		Note.—Government Contribution 25%.	
		Total	2,553.52

1	Alice and Fraser By-Law No. 7	Road Overseer—J. M. Kennedy	48.00
2	Medora and Wood By-Law No. 366	Road Overseer—James Matts	150.00
3	Olden By-Law No. 56B	Road Overseer—J. A. Cox	64.00
4	Palmerston and Canonto By-Law No. 244	Road Overseer—J. D. Miller	28.40
5	Sheffield By-Law No. 667	Road Overseer—Wm. Henry Johnson	112.00
6	Stephenson By-Law No. 523	Road Overseer—J. H. Osborne	150.00
		Note.—Government contribution 40%.	
		Total	552.40

MISCELLANEOUS

Inspection	$15,753.61
Engineering, Surveying and Locating Roads	6,856.95
Storage of Tools	6.00
Balance of Road and Inspection Accounts and Over-expenditures due from 1920	4,688.94
Road Machinery, Motor Trucks, etc.	4,652.25
Compensation to Injured Workmen	470.85
Hospital Services for same	51.00
Sunnidale Township (Drainage 1920)	500.00
Sudbury-Soo Trunk Road (Balance of 1916 Contract)	399.98
Southworth Township; Ignace Crossing	1.00
	$33,380.58

No.	Recapitulation	Cleared and Stumped	Graded and Shaped	Surfaced	Ditched	Cut and Fill	Bridges	Culverts	New Road	Old Road	Expenditure	No.
		rods	rods	rods	rods	cu. yds.	number	number	miles	miles		
											$ c	
1	Direct Grants	53,472	121,910	82,377	17,488	100,566	62	1,284	75.29	540.00	293,540.26	1
2	By-law Grants (Roads)	36,808	126,899	107,162	19,937	54,639	61	1,260	42.01	605.75	176,154.04	2
3	do (Machinery)										2,553.52	3
4	do (Overseer)										552.40	4
5	Miscellaneous										33,380.58	5
	Total	90,280	248,809	189,539	37,425	152,205	123	2,544	117.30	1,145.75	$506,180.80	

Gravenhurst-Bala Road, Muskoka District.

Appendix No. 45.

To the HONOURABLE BENIAH BOWMAN,
Minister of Lands and Forests, Ontario.

SIR,—I have the honour to submit to you the report on the construction and maintenance of highways and bridges, under the provisions of the Northern and North-western Ontario Development Act, 1912, and amendments, during the season ending 31st October, 1921.

The report has been prepared in tabulated form, which will be found more convenient for reference, and the districts, or sub-districts, are given in alphabetical order, as follows:

Algoma, Cochrane, Dryden, Englehart, Hearst, Kapuskasing, Kenora, Matheson, Muskoka, Nipissing-Sudbury, Parry Sound, Porcupine, Rainy River and Thunder Bay.

Trunk road construction and maintenance has received considerable attention during the year and the section of the Northern Highway, from Toronto

Severn-North Bay Trunk Road.

to North Bay, under the jurisdiction of this Branch, has been placed in very fair condition by the surfacing of the worst sections with either gravel or crushed stone.

At North Bay this road connects with the Pembroke-Mattawa-Sault Ste. Marie Road, on which many improvements and betterments were effected.

From Sault Ste. Marie eastward, this road is in excellent condition to a point about twenty miles east of Mattawa, and two gangs were engaged in the construction of the portion lying between Mattawa and Chalk River, which has never been opened up. The route being followed is mainly a parallel line to the Canadian Pacific Railway, connecting the various towns and villages. The old construction trail was partially brushed and repaired to provide for local traffic pending the completion of the Highway.

The portion of the Province served by the T. & N.O. Railway, and lying between North Bay and Cochrane, has no connection by road with Southern Ontario, as the Northern Highway, before referred to, only extends to Widdifield, a distance of about 12 miles north of North Bay. From this point to Latchford (Mileage 92) there is a stretch of 80 miles with practically no settlement, lying

"Hymers Hill," Thunder Bay District.

largely within the Temagami Forest Reserve, and no effort has yet been made in the direction of road construction in this area.

From Latchford northwards to Cochrane, there are a few stretches which, when connected up, will provide a continuous highway from the one point to the other. One of these stretches, from Krugerdorf to Swastika, was opened up this year and although not quite completed, vehicular traffic has been made possible between the Cobalt Silver Camp and the Kirkland Lake Gold Camp. Surveys have been made of the remaining portions and preliminary steps taken in regard to further construction.

From Porquis Junction to the Porcupine Gold Camp, approximately 25 miles of new trunk road was cut out to connect Porcupine and Timmins with the Latchford-Cochrane trunk road, and when completed this road will link up the Cochrane and Matheson Agricultural Districts with the mining camps as well as the pulp and paper centre at Iroquois Falls.

The East and West Highway along the Canadian National Railway between

Cochrane and Hearst, is only a series of disconnected stretches of road, at present serving local purposes; additional pieces of construction were carried out and the existing portions improved.

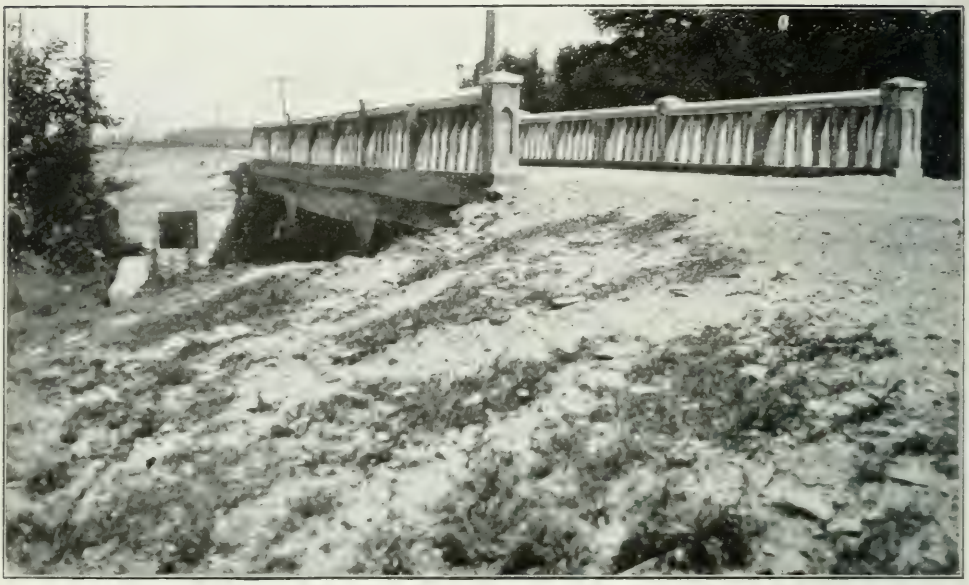
In North-western Ontario there are four sections with a large mileage of roads in each, but without any connection the one with the other, viz.: Thunder Bay, Kenora, Dryden and Rainy River.

Thunder Bay District has a well laid out road system, with the cities of Fort William and Port Arthur as its centre. The five main or trunk roads are: 1. The Eastern Highway, which when completed will connect the Twin Cities with Nipigon, and the route of this road follows closely along the Hydro-Electric pole line as far as construction has progressed, and it is the intention to follow the Hydro line until construction reaches Nipigon, except in the Dorion district, where advantage will be taken of the roads already constructed in that vicinity. II. The North-western Highway, known as the Dawson Road, from Port Arthur

Opening a new road, Rainy River District.

to Kaministikwia. This road was practically reconstructed this year and excellent returns given for the expenditure made. III. The International Highway, connecting the Twin Cities with the Minnesota State Road to Duluth at Pigeon River. Many expensive betterments were made on this road and satisfactory results obtained. A maintenance patrol system was adopted whereby the entire highway was kept in repair and the surface preserved and improved. IV. The Port Arthur Western Highway, known as the Oliver Road, and V., the Fort William Western Highway, known as the Arthur Street Road. These two roads carry a heavy traffic from the Twin Cities to Kakabeka and the flourishing agricultural area west, and many improvements were carried out in surfacing and road drainage.

In Kenora District the Town of Kenora is the hub of a series of roads, each running to one of the outlying parts of the district. The Kenora-Keewatin Road, which carries a heavy motor truck traffic, was resurfaced with crushed stone and good results obtained. The Pellatt Road, Redditt Road, Charlesbois Road, Ritchie Road, Homestake Mine Road and many others of less importance all received attention during the year, and a new road was opened up connecting the Pellatt Road with the Lulu Lake territory.



Bar River Bridge—Algoma District.

Typical Winter Scene, Temiskaming District.

In the vicinity of Dryden, which is a sub-district of Kenora, the Western Highway, which practically parallels the C.P.R., is the principal road, as it is the base of the road system of the district. This road, as well as the northern roads leading therefrom, to or in the direction of the C. N. Railway, received considerable attention during the year, the main highway especially being now in a very fair condition for automobile traffic.

The road system in the Rainy River District has as its base the trunk road from Fort Frances to Rainy River, and the heavy traffic on this road, which includes a motor bus plying between these points, called for a heavy expenditure in maintenance and betterments. The road follows the Rainy River, which is the Ontario-Minnesota boundary, and the country lying to the north of the river being very closely settled for miles away from the river, there is a constant demand not only for new roads, but for the improvement of the existing main or leading roads to the base, on which is situated all the market centres, Devlin, Emo, Barwick, Stratton, Pinewood, and other villages, being all situated on the main Fort Frances Rainy River Road. Each of these points demands and requires a main artery running northwards, and all have received as good a measure of attention as the appropriation would allow.

In conclusion I would add that a comparatively large portion of the appropriation for each district was this year expended in road drainage, and while this expenditure does not show a great mileage of roads constructed, it would give a large mileage of roads improved, as the maintenance cost on a well-drained system of roads is reduced to a minimum in comparison to the cost on poorly drained roads.

All of which is respectfully submitted.

I have the honour to be, Sir,

Your obedient servant,

C. H. Fullerton.
Director, Northern Development Branch.

Toronto, Ont., October 31st, A.D. 1921.

DEPARTMENT OF LANDS AND FORESTS,

ANNUAL REPORT OF WORK

ALGOMA DISTRICT.

		Cutting		Burning		Stumping and Grub'g		Grading		Cross Lay		Ditching		Gravelling	
		L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L ft.	W & D	L mls.	yds. used
	Trunk Rd., Sudbury to S. Ste. Marie														
1	I.—Sault Ste. Marie to Day Mills.	.08	66	.08	66	.08	66	.58	25			47520	cleared		5262
		.50	12	.50	12	.50	12	1	re			2640	deepened		
												18480	2½x3¼		
2	II.—Day Milles to Cutler	11.		si	debr	us	hing	6	18			10000	2 x1½		
												7600	2 x1½		
												2640	4 x1½		7719
3	III.—Cutler to Copper Cliff	5		si	debr	us	hing	25.	50 re			1000	2 x1½		1731
												400	2½x1½		
												400	2½x1½		
												1320	3 x1½		
												150	3 x2		
4	IV.—Webbwood-Massey Section					.5	12	6	30			500	3 x1½		
								.75	32			600	2 x1½		
												800	cleaned		
5	V.—Diversions near Spanish	1.5	66	2.5	66	1.5	30	2	30			400	3 x2		
												300	3 x2½		
				3	mile	s of	fence	erect	ed			150	2½x1½	2	1410
6	VI.—At Algoma Mills							.15	28			1584	3 x2		22
												1100	4 x3		
7	VII.—At Bar River														
8	VIII.—at Sucker Creek														20
9	IX.—At Ladouceur Creek														3
10	Desbarats, Kensington Road							.75	24			400			104
11	Goulais Bay Road	.1		brush	ed							125	1½x1		
												1995	2½x1		
												750	3½x2½		47
12	Lorne, Louise Road	1.75	40			.5	40					3168	2 x1½		552
												5280	2½x1½		
												100	3 x1		
13	Wharncliffe Road	4	25			2	30	.5	28			30040	2 x1½	8	124
		2	20			1	24	2.5	24			13200	3 x2½		
		2	brushed					2	22						
								2.5	20						
	St. Joseph's Island & Camp d'Ours.														
14	I.—General Maintenance					.9	14					1870	3 x2		150
												2310	2½x2		
												119	2 x1		
15	II.—Hilton Tp., "W" Line Road	.13	new road									528	2 x1½	.5	52
16	III.—Fifth Side Road							1	18					1.38	1310

NORTHERN DEVELOPMENT BRANCH.

Done, Year 1921.

Crushed Rock		Dragging Miles	Other Rep'rs Miles	Culverts				Bridges		Remarks	
Ld. Crushed	L covered			Wood	Stone or Conc.	Met.	Size	No.	Description		
		66		4 repaired						General maintenance.	1
				3 lowered						Repairs and small betterments, 66 miles.	
						2	15″				
						2	altered				
		51				2	14″			General maintenance.	2
						1	18″			Repairs and small betterments, 51 miles.	
						3	16″				
						1	26″				
				4			16x12″				
		78				1	24x 8″			General maintenance.	3
						16	24x18″			Repairs and small betterments 78 miles.	
						2	24x24″				
						1	26x36″				
						2	18x24″				
785	3.4			1			26x24″			Stone road.	4
						1	26x18″			12′ wide, 8″ thick.	
											5
		2				1	26x18″				
						1	26x36″			Three diversions eliminating five bad hills.	
						2	24x24″				
						1	30x30″				
				4 improved							
3514 c.y. excavation										Constructing subway.	6
782 c.y. filling											
311 railing						1	30″				
					1		450′x4′x4′				7
ed for fill								1	Reinforced concrete, 16′x-16′		8
12 c.y. stone											9
				1	re-covered			1	Unfinished	Hill cut, 300′x2 Earth fill, 60′x20′x7′. Rock and Gravel fills { 378x3 / 200x2½ / 100x2½ / 150x4	10
											11
		4		2			14x6			Rock cut, 15′x4′x3′.	
		.5		12 repaired 7	1					Scow repaired and approaches built.	12
				25			20x4	1	Repaired.	88 c.y. stone. 347 c.y. filling.	13
		44		4			16x2x2			Dock built.	14
				4			14x2½x2				
				2			18x2x2				15
											16

11 L.F.

DEPARTMENT OF LANDS AND FORESTS.

ANNUAL REPORT OF WORK

ALGOMA DISTRICT.

	Cutting		Burning		Stumping and Grub'g		Grading		Cross Lay		Ditching		Gravelling	
	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L ft.	W & D	L mls.	yds. used
17 IV.—"U" Line Road	1.25	s i deb' d			.25	16	1.25	20					1.25	102
18 V.—Richardson's Creek	2	14			2	14	Creek cleared for drainage of road							
	2	16												
19 VI.—"P" Line and 10th Side Rd.							.5	18					1.25	394
Manitoulin Island.														
20 I.—Gore Bay to Silverwater and	5	66	.75	66	2.25	26	4.25	26			600	3 x2		593
and					.5	36								
Silverwater to Meldrum	2.88	60	3.25	60	1.25	30	1.25	28						
					1.5	40								
					.25	28	.75	30						
21 Little Current to Sheguindah	1	32	1	32	1	16	1	16			990	4 x1	2.25	21
and	.75	66			.75	40	.25	26						
Kajawan to Gore Bay							.75	30						
22 Gore Bay to Long Bay	.75	66	.6	50	.75	30	1.5	16					1.5	16
	.6	60			.6	50								
23 Long Bay to Spring Bay	3.5	66					2.75	28					2.75	23
24 Spring Bay to Providence Bay	2	66			2	40	3	28			2640	2 x1½	3.25	35
25 Providence Bay to Mindemoya													.75	4
26 Around Mindemoya Lake							2	30					2	7
27 Sheguindah to Manitowaning	.75	50					.08	22			300	16x1	1	12
							.13	26						
							1.75	24						
28 Green Bay Road	.5	40			5	40	2	24			246	1½x1½	1	20
											500	2 x1		
29 Little Current to Honora	3.5	26					5	24					2	
30 On Barrie Island							1.25	24					1	5
COCHRANE DISTRICT.														
Township. Location.														
31 Brower: Abitibi S., to line bet. 8&9														
32 Bet. lots 8 and 9, Con. 5														
33 Bet. Cons. 2 &3, lots 9 to 12														
34 Bet. Cons. 2 & 3, lots 5 & 6	.75	66	.75	66										
35 Bet. Cons. 5 & 6, lots 1 & 2	.63	66												
36 Calder: Bet. Cons. 8 & 9, lot 25														
37 Bet. Cons. 2 & 3, lot 28, & lots 1 & 2	.75	66	.75	66			1	33			196	3 x2		
38 On lot 1, Con. 1											1155	4 x2½		
39 Bet. Cons. 2 & 3, lots 1 & 2							.25	24						
40 Calvert: Across pt. Con. 1, lot 10.							.34	33			900	3 x3½		
											1800	re		
41 Trunk Road to Iroquois Falls							1	25 24			1300	4 x4		
											5600	re		
42 Bet. Cons.1 & 2, lots 9 & 10	.25	66	.25	66	.25	24					8596			
43 Clergue: Bet. Cons. 4 & 5, lot 5							11	24						

NORTHERN DEVELOPMENT BRANCH.

DONE, YEAR 1921.

Crushed Rock		Drag-ging Miles	Other Rep'rs Miles	Culverts				Bridges		Remarks	
ds. sh-ed	L. cov-ered			Wood	Stone or Conc.	Met.	Size	No.	Description		
		2.25		1			14x2x2				17
											18
				1			16x2x2				19
		3.5		1			16x1x1	1		Stone fills, Earth fills,	
				7			16x8x8			16x12x2 66x4x2	20
					1		16x5x4			100x5x1½	
					5		16x1x1			2475x3½x1½	
				5			16x3x2			495x6x1	
					1		16x6x3			100x16x2	
					1		16x6x2				
					1		16x5x1				
525	2				1		16x3x4			4 stone fills, 100'x6½x1½.	21
					2		16x2x2				
					1		16x4x3				
		.5			2		16x7x3			Earth fill, 1650'x12x8".	22
							16x4x3				
					3						23
		3			4		16x4x3	1	Covered.	Earth fill, 100x16x1.	24
					3		16x2½x2½				
				1			16x3x3				
				1			16x2x2				
					1		18x6x3				
											25
		3									26
										Fill, 74'x5'x15".	27
		4.50	6		2		16x2½x2½			Fill, 462'x26'x4½'.	28
			.5	11			16				
											29
					3		16x3x1½				30
				1			16x4x3				31
				2			16x3x3				
			.07	1			16x3x3				32
				10			16x4x3				33
											34
											35
										Scow constructed.	36
				3			16x4x3				37
											38
								1	30x19x6.	100 c.y. earth fill.	39
				2			20x3x3				40
				1			16x1½x1½				41
											42
				1			16x2x2	1	16x8x8.	1300 yds. earth excavation	43

DEPARTMENT OF LANDS AND FORESTS,

ANNUAL REPORT OF WORK

COCHRANE DISTRICT

	TOWNSHIP—LOCATION	Cutting		Burning		Stumping and Grub'g		Grading		Cross Lay		Ditching		Gravellin	
		L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L ft.	W & D	L mls.	yds use
44	Across pt. Con. 6, lot 10							.6	24			2000	4 x3		
45	Clute: Bet. Cons. 10 & 11, lot 26														
46	Bet. Cons. 10 & 11, lots 23-26	.25	66	.25	66	.2	33	.2	33			244			
						.5	24	1.12	24			759	3½x4½	.1	10
47	Bet. lots 12 & 13, Con. 6														
48	Bet. Cons. 2 & 3, lots 3 to 5					.1	re	1	re						
49	Bet. Cons. 6 & 7							.25	33						
50	Bet. Cons. 2 & 3, lot 28							.08	33						
51	Bet. lots 12 & 13, Boundary of Fournier to Frederickhouse	.4	66	.4	66			1.4	30			1800	4 x2		
												5808			
												2442	4 x3		
52	Bet. Cons. 6 & 7, lots 13 to 17											15523			
53	Bet. Cons. 8 & 9, lots 13 to 18	1	66	1	66							2737			
54	Fauquier: Bet. lots 12 & 13, Cons. 3 to 6													2.5	
55	Fournier: Bet. lots 7 & 8, Cons. 5 & 6	1	66	1	66										
56	Bet. lots 8 & 9, Con. 6	1.25	66	1.25	66			1.25	24			1650	4 x3		
57	Bet. lots 4 & 5, Con. 6											990	5 x4		
												10956			
58	Bet. Cons. 5 & 6, lots 1, 2 & 3														
59	Bet. lots 10 & 11, Con. 6	.37	66	.37	66			.7	24						
60	Fox: Bet. lots 8 & 9, Cons. 1 to 3	1.25	66	1.25	66	.82	24					11652			
61	Bet. Cons. 2 & 3, lots 9 to 12	1.25	66			1.25	24					16509			
62	Bet. lots 4 & 5, Cons. 2 & 3 / Bet. Cons. 3 & 4, lots 3 & 4			3.1	24	3.1	24					33495			
63	Bet. lots 4 & 5, Cons. 1 & 2	1.2	66	1.2	66										
64	Bet. lots 10 & 11, Con. 2	1	66	1	66										
65	Bet. Cons. 4 & 5, lots 1, Brower 12 Fox											8726			
66	German: Connaught Dam Rep'rs.														
67	Glackmeyer: Bet. Cons. 2 & 3, lots 19 to 28													2.5	
68	Lamarche: Bet. Cons. 4 & 5, lots 5 & 6	.82	66	.82	66	.75	24	.5	24			4735			
69	Bet. lots 4 & 5, Con. 3	1	66			1	24								
70	Bet. lots 8 & 9, Con. 6											1320		.25	
71	McCart: Bet. Cons. 2 & 3, lot 4	.5	66	.5	66										
72	Bet. Cons. 2 & 3, lot 3			.5	24	.5	24					2640			
73	Newmarket: Bet. Cons. 1 & 2, Trunk Road, to Lot 4	1	66	1	66	1	24					12341			
74	Trunk Road, lots 4 & 5, Con. 5			.75	33	.75	33					8100			
75	Bet. Cons. 4 & 5, lots 3 & 4											7950			
76	Bet. Cons. 5 & 6, lots 5 & 6											14800			
	BOUNDARY LINES.														
77	Blount,—Leitch: Across Con. 1							.2	24			660	4 x3		
78	Across Cons. 1, 2 & 3							.2	24	.2	24				
79	Blount—Clackmeyer: Across lots 15, 16, 17	.2	66	.2	66			.2	24	.2	10	1188	4 x4		
80	Brower—Kennedy: Across lots 2 to 9, Brower							.33	32			330	3 x3		

NORTHERN DEVELOPMENT BRANCH

DONE, YEAR 1921.

Crushed Rock		Drag-ging Miles	Other Rep'rs Miles	Culverts				Bridges		Remarks	
ds. ush-ed	L. cov-ered			Wood	Stone or Conc.	Met.	Size	No.	Description		
				1			16x4x4				44
				1			16x3x3				
				1			20x1½x1½				
								1	80x14 (piles).		45
				2			16x4x3			45 c.yds. hill cutting.	46
				3			16x3x3			2000 c.yds. filling.	
			.06								47
				2	repaired						48
				1			16x5x4				
											49
											50
			1.75	3			20x4x3				51
				2			16x4x3				
				6			16x3x3				52
											53
											54
				6			16x4x4				55
				5			16x4x2				56
											57
				5			16x3x3				58
				5			16x4x4				
				2			16x3x3				59
											60
											61
				7			16x6x6				62
											63
											64
											65
											66
											67
				4			16x4x3				68
				7			16x3x3				
											69
				2			16x3x3	1	20x6x6.	504 c.yds. hill cutting.	70
								1	20x16x7.	888 c.yds. clay excavation	71
											72
											73
											74
											75
											76
											77
											78
				4			16x4x4				79
			1.9	1			3				80

DEPARTMENT OF LANDS AND FORESTS.

ANNUAL REPORT OF WORK

COCHRANE DISTRICT

	TOWNSHIP—LOCATION	Cutting		Burning		Stumping and Grub'g		Crading		Cross Lay		Ditching		Gravelling	
		L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L ft.	W & D	L mls.	yds. used
81	Across lot 3, Brower									.07	10	200	3 x2½		
82	Across lot 27, Kennedy			Dock and Cable repaired.								Scow Install ed.			
83	Brower—Fox: Across Cons. 1 & 2.	2.	66	2	66			.2	33						
								2	24						
84	Brower—Lamarche: Across Cons. 6														
85	Calder—Clute: Across Cons. 1 & 2.							.7	30						
								.3	33			4881			
86	Across Cons. 2 to 10							1.2	33						
87	Calvert—Teefy: Across Con. 3.			Placing equipment for erection of bridge											
88	Clergue—Walker: Across Con. 5							.46	24			5280	3 x2		
89	Clute—Fournier: Across lot 13							.12	33						
90	Across lot 14 to 16.	.25	66	.25	66			.25	30						
								.31	33			240	5 x3		
91	Across lot 1 to 5, Fournier	1.9	66	1.9	66			1.9	30			11400			
92	Clute—Glackmeyer: Across lot 8 to 12							.5	30						
93	Across lots 5 to 8	6 acres under brush		.7	66			2	33			1300		1	
94	Fournier—Lamarche: Across Cons. 4, 5 and 6							.9	33			291			
												4554			
95	Fox—Pyne: Across lots 9 to 12							2	66	1.9		24	1.9	24	
												66	I3619		
96	Glackmeyer—Lamarche: Across lots 23 to 28													2	
	DRYDEN DISTRICT.														
97	Aubrey: Bet. lots 3 & 4, Con. 5													.75	7
98	Drayton: Bet. lots 2 & 3, Con. 3													.25	r
99	Bet. lots 2 & 3, Con. 3, and through lots 3 & 4, across Cons. 3 & 4.	1.5	66	1.5	66	1.5	35	1.5	22						
100	Eton: Trunk Rd., Bet. Cons. 1 & 2													4	32
	Bet. lots 1 to 2													1.5	
101	Bet. lots 6 & 7, Cons. 3 & 4													63	22
102	Bet. Cons. 3 & 4, lots 6 to 9													1.5	
103	Bet. Cons. 5 & 6, lots 4 to 6	1.	66	1.	66	1.	35			.001	16	1320			
104	Mutrie: Bet. lots 10 & 11, Cons. 3 & 4	1.5	66	1.5	66	1.5	35	.25	22	.3	16	2046			
												7342			
105	Sandford: Bet. 2 & 3, Cons. 1 to 4.	1.5	66	1.5	66	3	35	4	22			425			
106	On lot 2, Con. 4			Cut hills and made approaches to Wabigoon River											
107	Southworth: Bet. lots 10 & 11, Cons. 4 & 5, and in lot 11, Con. 5	1	20							.006	16				
108	Wabigoon: Bet. lots 8 & 9, Con. 6, and in lots 8 to 11, Cons. 1 & 2	4.7	66	2.5	66	3.7	35	5.5	22	1	16	18810			
	Redvers: Redvers Township														
109	Wabigoon: Bet. lots 8 & 9, Cons. 3, 4 & 5, and Bet. Cons. 5 & 6, lot 9													3.5	37
110	Wainwright: Bet. lots 8 & 9, Con. 1													1	8
111	Bet. Cons. 1 & 2, lots 9, 10 & 11.													1	8
11	Zealand: Trunk Rd., across lots 10 to 14													2.5	6

NORTHERN DEVELOPMENT BRANCH.

DONE, YEAR 1921.

Crushed Rock		Dragging Miles	Other Rep'rs Miles	Culverts				Bridges		Remarks	
Yds. Crushed	L. covered			Wood	Stone or Conc.	Met.	Size	No.	Description		
											81
											82
				6			16x3x3				
				1			16x2x2	1	16x10x5.	1350 c.yds. hill cutting.	83
			.04	1			16x1½x1½	1	Repaired.		84
				2			16x4x3				85
				2			16x3x3				
				11			16x3x3				86
											87
											88
											89
				3			20x4x4				90
				2			24x4x4				
				2			20x4x3	1	20x6x5.		91
				5			16x3x3				92
				4			16x3x3			150 c.yds. hill cutting.	93
				5			16x3x3				94
				4			16x4x3				95
											96
											97
											98
				2				1	30'x 16.		99
											100
											101
											102
				1			28x4x4			100' filling, 10' deep.	103
				1			30x6x6			300' hill cutting, 4' deep.	
				5						75 mile earth covered.	104
				11							105
ridge		1.5 miles of road earth covered.									106
											107
				19	1						108
											109
											110
											111
		3.5								Hill cut & fill, 120'x36'x4'.	11

DEPARTMENT OF LANDS AND FORESTS,

ANNUAL REPORT OF WORK

DRYDEN DISTRICT

	Township—Location	Cutting		Burning		Stumping and Grub'g		Grading		Cross Lay		Ditching		Gravelling	
		L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L ft.	W & D	L mls.	yds. used
113	Trunk Rd., on lot 6, Con. 1, and across lot 7 bet. Cons. 3 & 2														600
114	Bet. Cons. 2 & 3, lots 4, 5-6	.5	66	.5	66	.5	35	1.25	22			1000			
	BOUNDARY LINES.														
115	Aubrey—Eton: Lots 1, 2 & pt. 3													1.25	102
116	Aubrey—Sandford: Trunk Rd, lots 4 to 11, through lots 11 & 12, Con. 6, Aubrey, and across lot 3, Con. 6, Temple Township			8 brush				2	re					4 5	345
117	Eton—Rugby: lots 2 to 6	2.5	66			2.5	35	2.5	22			1155			
118	Lots 7, 8 & 9									.01	16	2343			
119	Eton—Wainwright: Cons. 1, 2 & 3													2	164
120	Wainwright—Zealand: Cons. 8 to 10, Zealand	.9	66	.9	66	.9	35					500			30
121	Wainwright, Britton and Rowell: Dryden—Richan Road	2.5	66					2	22			3144			
122	Trunk Road from Wabigoon in Zealand Twp. to Quibell in Wabigoon Twp.														
	ENGLEHART DISTRICT.														
123	Beauchamp: On lot 9, Con. 4	48, 17	7 ft.	B. M. of bridge timber, cut skidded and hauled—											
124	Catharine: On lot 3, Con. 3														
125	Chamberlain: On lot 1, Con. 6			Grade s reduced on approaches to Krugersdorf Bridg											
126	Bet. Cons. 5 & 6 lot 5														
127	Bet. Cons. 2 & 3, lot 8														
128	Bet. Cons. 1 & 2, lot 8							.5	20						
129	Dack: Bet. lots 8 & 9, Con. 2			Grade s reduce d on two hills.											
130	Bet. lots 8 & 9, Con. 3			Grade s reduce d on two hills.											
131	Evanturel: On lot 9, Con. 4	.25	12	.25	12	.25	10					1320	3 x3		
132	Bet. Cons. 5 & 6 lot 12							.5	30						
133	Gauthier: Larder Rd. to Argo Mine														
134	Ingram: Bet. lots 10 & 11 across Cons. 4 & 5	2	66	2	66	in part									
135	Bet. Cons. 3 & 4 across lots 3 & 4			Straightening water course and building dam..											
136	Bet. Cons. 1 & 2, lot 8											2340	3 x2		
137	Lorrain: N. Cobalt to Paradis Bay.														
138	Bet. lots 4 & 5 across lot 11					.5	20	.5	15						
139	Marter: Bet. lots 10 & 11, Con. 2			Approaches to steel bridge re-constructed and grade											
140	Bet. lots 4 & 5, Con. 4														
141	Bet. Cons. 4 & 5, lot 3							.5	28						
142	Pacaud: Bet. lots 6 & 7, Con. 2	1	66												
143	Robillard: Bet. Cons. 5 & 6, lots Lots 6 & 7	.5	66			.75	20	.75	18						
144	Savard: Bet Cons. 2 & 3, lot 3														
145	Bet. Cons. 3 & 4, lot 12							.5	20						
146	Sharpe: Bet. Cons. 1 & 2, lots 1 & 2							.1	20						
147	Bet. Cons. 2 & 3, lots 2 & 3							2	30	Grade reduced on seven hill					

NORTHERN DEVELOPMENT BRANCH.

DONE, YEAR 1921.

Crushed Rock		Drag-ging Miles	Other Rep'rs Miles	Culverts			Bridges		Remarks	
Yds. Brush-ed	L. cov-ered			Wood	Stone or Conc.	Met. Size	No.	Description		
									25 mile clay covered.	113
				3						114
										115
										116
				7						117
			1.25						1 mile sidebrushed, 12' wide.	118
										119
			1.75	6			2	With fills and approaches.		120
			11	90		16x4x2			339 c.yd. in fills.	
				11		16x9x3			1401 c.yd. clay covered.	121
		55								122
75	piles and		10 pieces special bridge timber.							123
							1	18' span renewed.		124
							1	60' " (timber)		125
							1	38' " "		126
							1	20' " "		127
				2		16x3x2				128
										129
							1	Repaired.		130
										131
				1		16x3x2				132
			6.75							133
										134
										135
										136
			9				3	Recovered		137
duced.				1		16x3x3				138
duced.										139
				1 removed			1			140
										141
										142
				1		16x5x4				143
				2		16x4x3				
							1	30'span.		144
										145
				1		16x8x3				146
				3		16x3x3				147
				2		16x8x3				
				1		16x12x5				
				1		16x6x5				
				1		30x6x5				
				1		30x3x2				

DEPARTMENT OF LANDS AND FORESTS.

ANNUAL REPORT OF WORK

ENGLEHART DISTRICT.

	TOWNSHIP—LOCATION	Cutting		Burning		Stumping and Grub'g		Grading		Cross Lay		Ditching		Gravelling	
		L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L ft.	W & D	L mls.	yds. used
148	Sharpe: Bet. lots 2 & 3, Con. 3, and Cons. 3 & 4, lots 3 to 6	3	66	3	66										
149	Bet. lots 2 & 3, across Con. II, and across lots 2 & 3	1.25	66	1.25	66										
	BOUNDARY LINES.														
150	Catharine—Pacaud: Cons. 1, 2, & 3														
151	Dack—Evanturel: Cons. 3 & 4			Grade reduction on hills.											
152	Evanturel—Ingram: Con. 5			Grade reduction on hills.											
153	Evanturel—Marter: Lot 10														
154	Robillard—Savard: Lots 11 & 12			Grade reduction on hills.				1	20						
155	Lot 5													.1	1
156	Robillard—Truax: Cons. 6			Grade reduction on hills.				.75	20						
157	Savard—Sharpe: Cons. 1 & 2							2	20						
158	Con. 4							1	20						
159	Sharpe—Truax: Lots 1 & 2			Grade reduction on hills.				.75	20						
160	Rd. from Elk Lake to Matachewan					3	10								
161	" Dane to Larder Lake														
162	" Boston Creek to Skead	4.01	18	4.01	18	4.01	18	4.01	16	.25	16	6090		.3	
163	" Swastika to Kirkland L.														
164	Branch Road from Swastika to Coal Chutes											60		.14	2
165	Latchford—Cochrane Trunk Rd., Krugerdorf to Swastika	10.5	66	9.2	66	2.3	33								
						9.4	26	2.1	22			13980		2 Con	cret
166	Rd. from Krugerdorf to Miller Ind. Mine	2.4 wide	5	8.25 ning	66	8.25	30	2.38	18			4890			
167	" " Tough Oakes Mine to Crystal Lake					3.54	30	1.	18	.45	16	13654			
168	" from Rosegrove to Round Lake			6.4	66	6.4	22								
169	from Boston Creek to Round Lake	2.26	66	2.07	66	1.76	30								
170	from Charlton to Elk Lake									.05	16				
171	" Elk Lake to Gowganda	1.6	66	1.6	66	1.6	22	13.5	16			10667		11.5	
	HEARST DISTRICT.														
172	Casgrain: Bet. Cons. 4 & 5, lots 23 and 24	.33	66	.33	66	.33	24					268	3½x1½		
												2800			
173	Bet. lots 24 & 25, Cons. 4, 5 & 6							.6	33			24235		.5	
174	Bet. Cons. 6 & 7, lots 20 to 24	1.6	66	.63	66										
175	Bet. lots 18 & 19, Cons. 1 to 6													1.5	
176	Bet. Cons. 4 & 5, lot 19													.31	
177	Hanlan: Bet. lots 12 & 13, Cons. 1 & 2	1.5	66	1.5	66	.75	24					5500			
178	Bet. Cons. 2 & 3, lots 16 to 22	1.25	66	1.25	66	1.25	24					11142			
179	Bet. lots 18 & 19, Cons. 3, 4 & 5	2.23	66	2.23	66	2.23	24					10139			
180	Bet. Cons. 1 & 2, lots 1 to 8	.81	66			1.5	24								

NORTHERN DEVELOPMENT BRANCH.

Done. Year 1921.

Crushed Rock		Drag-ging Miles	Other Rep'rs Miles	Culverts				Bridges		Remarks	
Yds. rush-ed	L. cov-ered			Wood	Stone or Conc.	Met.	Size	No.	Description		
											148
											149
			3								150
ile for subsoil d rainage				2			32x4x3				151
						1	125'x 24'				
								1			152
								1	80' span ready for steel.		153
				7			16x5x3				154
										Cut widened on sand hill.	155
											156
				1			24x5x3				157
											158
				1			26x5x3				159
				4			16x5x3				
											160
1150			12	56	renewed						161
			3.75	12			16x4x2	1	68'x 16'.		162
300	.6					1	12"				163
						3	12"-				164
											165
abut-	1–20 x8					4		1	62x14.		
ments	1–20 x4			28			22x4x3	1	120x14.		
				16			16x4x2	1	19x16x4.		166
								1	44x16x4.		
			.5	15			16x3x2				167
								1	120' long.		168
								1	120' long.		169
				3			16x4x2				170
				23		3	2x1½	1	16x11x4.	10.4 miles brushed out.	171
										New road.	172
			1.75	2			16x3x2				173
											174
			4								175
			.25								176
											177
				2			16x3x3				178
											179
											180

DEPARTMENT OF LANDS AND FORESTS,

ANNUAL REPORT OF WORK

HEARST DISTRICT

	TOWNSHIP—LOCATION	Cutting		Burning		Stumping and Grub'g		Grading		Cross Lay		Ditching		Gravelling	
		L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L ft.	W & D	L mls.	yds. used
181	Trunk Road, lots 13 to 20							.85	re						
182	Kendall: Bet. Cons. 8 & 9, lots 19 to 24											19747			
183	Bet. lots 18 & 19, Cons. 7 & 8	.66	66	.66	66	1.5	24								
184	Bet. lots 24 & 25, Cons. 11 & 12	.3	24	.3	5							5000			
185	Kendall: Bet. lots 12 & 13, Cons. 7, 8 and 9														
186	Bet. Cons. 11 & 12, lots 19 to22														
187	Bet. lots 24 & 25, Cons. 9 & 10											1200			
188	Bet. Cons. 10 & 11, lot 19														
189	Bet. Trunk Road, lots 24 &25											2050			
190	Trunk Road, lots 5 to 23														
191	Way: Bet. Cons. 2 & 3, lots 1 to 16	1.6	66	1.6	66	.45	24					53129			
192	Bet. Cons. 10 & 11 lots 3 to 12					.65	24	1	re			4750			
193	Bet. Cons. 8 & 9, lots 2 to 6											16746			
194	Bet. lots 6 & 7, Cons. 1 & 2	1.5	66												
195	Bet. Trunk Road, lots 3 to 12							.5	re						
	BOUNDARY LINES.														
196	Casgrain—Hanlan: Across Cons. 3 & 4					1.5	24								
197	Hanlan—Way: Across lots 8 & 9	.63	66	.63	66	.63	24								
198	Kendall—Way: Across Cons. 7, 8 & 9											7500			
199	Across Cons 3 to 6	.75	66			1.73	24					898			
200	Lowther—Way: Across lots 7 & 9	.63	66												
	KAPUSKASING DISTRICT.														
201	Fauquier: Bet. lots 6 & 7, Cons. 3 & 4, and Cons. 4 & 5, lots 6 to 12									.1	12	44560			
202	Bet. lots 12 & 13, Cons. 1 & 2	1.5	66												
203	Bet. lots 6 & 7, Cons. 1 & 2	1.5	66	1.5	66										
204	On lots 8 & 10, Con. 5														
205	Trunk Road, lots 10, 11 & 12											15060			
206	Trunk Road, M.P. 50½ to 57			.5	28	.5	28					5280			
207	Trunk Road, M.P. 57 to 62½											71080			
208	O'Brien: Bet. lots 25 & 26, Cons. 11 & 12	.5	66	1.	66	1.	24	.5	24			7000			
209	Bet. Cons. 10 & 11, lots 19 to 24											5280	re		
210	Bet. lots 24 & 25, Cons. 9 & 10											2640	re		
211	Bet. lots 18 & 19, Cons. 11 & 12														
212	Trunk Road, M.P. 65½ to 69½											13200	re		
213	O'Brien & Owens: Trunk Road, M.P. 69½ to 73														
214	Owens: Trunk Road, lots 4 & Con. 13			.5	28	.5	28	.5	26			5000			
215	Shackleton: Bet. lots 24 & 25, Cons. 8 to 11	2	66			3	24								
216	Trunk Road, M.P. 42 to 46	4	66	4	66	4	28					47240			
217	Trunk Road, M.P. 46 to 49½											41060			
218	At Ground Hog River Crossing			Sco	w	and		ca	ble	rep	ai	red	an	d	cul

verts repai redor

NORTHERN DEVELOPMENT BRANCH.

Done, Year 1921.

Crushed Rock		Dragging Miles	Other Rep'rs Miles	Culverts				Bridges		Remarks	
Yds. crushed	L covered			Wood	Stone or Conc.	Met.	Size	No.	Description		
			3.50	3			16x4x3			1500' clay sheeted, 10' wide	181
				4			16x3x2				182
											183
			1.50	4			16x4x3			6000' clay sheeted, 8' wide.	184
			1	1			50x14	1	Temp'y Floating.	500' clay sheeted, 8' wide.	185
			1.25	6			16x3x3			700' clay sheeted, 8' wide.	186
			1	2			16x3x2				187
								1	40' long improved with "A" truss.		188
			.75	2			16x3x3			—.	189
			5	3			16x3x2			5000' clay sheeted, 8' wide.	190
				10			16x3x2				191
			2.25	5			16x4x3				192
											193
											194
			2.25	2			16x3x2			7500' clay sheeted, 10' wide	195
											196
											197
			2.25							3500' clay sheeted, 10' wide	198
											199
											200
				10			16x5x3	1	Wood, 16x11x9.		201
											202
											203
										2 mls. of creek cleared.	204
											205
			5.50	4			16x5x3			1 mile of creek cleared; 1320' clay surfaced.	206
				18			16x5x3				207
				6			16x4x4				208
		3		7	repaired						209
		.75		3	repaired						210
		6		4	repaired						211
				10	repaired					2000' offtake ditch cleaned 2 miles clay surfaced.	212
		3.50		6	repaired						213
		1.50		5			16x4x4				214
											215
											216
											217
Trunk Road.											218

DEPARTMENT OF LANDS AND FORESTS.

ANNUAL REPORT OF WORK

KAPUSKASING DISTRICT.

TOWNSHIP—LOCATION	Cutting		Burning		Stumping and Grub'g		Grading		Cross Lay		Ditching		Gravelling	
	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L ft.	W & D	L mls.	yds. used
BOUNDARY LINES.														
219 Fauquier—Nansen: Across lots 7 to 12.	1.75	66	....											
KENORA DISTRICT.														
220 Jaffray & Mellick: Main East Mellick Rd. (Pelletier Branch) East Charlesbois Road	.5	40	.5	40	.5	40	.5	16			2640	3 x1	....	46
221 Con. 1, lot 2, Con. 2	.6	40	.6	40	.4	30	.3	18	.1	14	1700	3 x2	....	13
222 Con. 2, lot 1, Con. 3			.3	40	.5	40	.3	40	.3	15	2080	3 x1½	....	105
223 Con. 3, lot 2, and J.A. 3					.4	30	1.0	20						260
224 Coker Road, lots 5, 6 & 7, Con. 3.	.4	30			.4	30	.3	12	.1	14	1600	4 x1	....	
225 Pellatt: Branch to Lulu Lake	1.66	66	1.66	66	1.66	30	2.25	16			2490	3 x2	....	160
226 Pellatt Road							12	re						4
227 Keewatin westwards					.51	30					3000	3 x8	....	91
228 Kenora-Keewatin Road											4650	2 x1¼	....	23
229 Redditt: Kenora-Redditt Road	.8	40	.8	40										
I, on lots 5 & 6 Con. 5	.3	50	.3	50	.5	30	.3	12	.1	16	1995	3 x1	....	20
230 H, lots 12, 13, 14, Cons. 4, 5	3.5	40	3.75	40	1.75	40	1.5	18			10020	3 x2	3.5	120
231 Beatty: Bet. lots 11 & 12, Cons. 1 & 2					.8		2	22			900	3 x2		
232 Bet. lots 9 & 10, Con. 3							1	22			200	3 x2		
233 Benoit: Bet. lots 6 & 7, Con. 2							1	22			500	3 x2		
234 Bet. Cons. 5 & 6, lots 3 to 9	2.63	66	1.63	66										
235 Bond: Bet. lots 2 & 3, Cons 3 & 4.							1.76	22			662	3 x2		
236 Bowman: Bet. Cons. 4 & 5, lots 11 & 12							1	22			150	3 x2		
237 Bet. Cons. 5 & 6, lot 10					.5	33	.5	22						
238 Bet. Cons. 3 & 4, lots 7 & 8					1	26								
239 Bet. lots 6 & 7, Con. 3	1	66	1	66										
240 Bet. lots 2 & 3, Con. 3					1	26								
241 Carr: Bet. lots 4 & 5, Con. 1														
242 Bet. Cons. 3 & 4, lots 1 to 4							2	re						
243 Bet. Cons. 5 & 6, lots 5 to 9							2.5	re						
244 Bet. lots 4 & 5, Cons 1 to 6	Filled was houts at culverts and bridge approaches													
245 Bet. Cons. 2 & 3, lots 4 & 5	Filled was houts at culverts and bridge approaches													
246 Bet. lots 2 & 3, Cons. 1 & 2														
247 Bet. lots 2 & 3, Cons. 5 & 6	.88	66	.88	66	1.38	33								
248 Bet. Cons. 4 & 5, lots 9 & 10	1	66	1	66	1	33	.73	22			300	3 x2		
249 Bet. Cons. 3 & 4, lots 5 & 6							1	22			200	3 x2		
250 Clergue: Bet. Cons. 2 & 3, lots 2 & 3							1	22			300	3 x2		
251 Bet. lots 2 & 3, Con. 1					1	26								
252 Currie: Bet. Cons. 4 & 5, lot 1														
253 Bet. Cons. 4 & 5, lot 5					.5	33	.5	22			300	3 x2	.1	
254 Hislop: Bet. Cons. 1 & 2, lot 5														
255 On lot 6, Con. 2														

NORTHERN DEVELOPMENT BRANCH.

DONE, YEAR 1921.

Crushed Rock		Dragging Miles	Other Rep'rs Miles	Culverts				Bridges		Remarks	
Yds. rushed	L covered			Wood	Stone or Conc.	Met.	Size	No.	Description		
											219
											220
				2			16x2x1½				221
				1			18x4x1¾				
				1			20x3x2				
			.25	5							222
				2			18x2x2				223
				4			18x2x2			Washouts repaired.	224
				10						Filling, 300'x 26'x 3'.	225
				6	repaired						226
			1.2		1	3				1537 c.yd. rock blasted and used in fills.	227
106	41									2465 c.yd. rock blasted and used in fills.	228
1490										550 c.yd. filling. 1500 c.yd. rock fill.	
										69' filling in br. approach.	229
				24			18x2x1			165'x 20'x 4' filling.	230
				8			18x3x2				231
				4			18x3x2				232
				5			18x3x2				233
											234
				11			18x3x2				235
				4			18x4x4				236
				4			18x4x4				237
											238
											239
											240
								1	Pile bridge, 650' long, rebuilt.	40 yards rock repaired washouts.	241
											242
											243
		6									244
											245
		2									246
											247
				8			18x3x2	1	20x16x5.		248
				5			18x3x2				249
					2		28'x 3'				
				9			16x4x4				250
											251
				1			30x16x6			1270 c.yds. filling.	252
				4			18x4x4				253
								1	144x16x8.		254
								1	Timber truss on piles, 138'x16x8		255

DEPARTMENT OF LANDS AND FORESTS,

ANNUAL REPORT OF WORK

MATHESON DISTRICT

	TOWNSHIP—LOCATION	Cutting		Burning		Stumping and Grub'g		Grading		Cross Lay		Ditching		Gravelling	
		L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L ft.	W & D	L mls.	yds used
256	Bet. Cons. 5 & 6, lot 10														
257	Bet. Cons. 1 & 2, lots 1 to 5	2.5	66	2.5	66										
258	Bet. Cons. 5 & 6, lots 2 & 3							1	22			100	3 x2		
259	Bet. lots 9 & 10 Cons. 2 & pt. 3							1.5	22			2000	4 x3		
260	Bet. lots 3 & 4, Con. 5							1	22			400	3 x2		
261	Bet. lots 9 & 10, Con. 1	1	66	1	66	1	26	1	22			1500	4 x3		
262	Bet. lots 5 & 6, Con. 1, and bet. Cons. 1 & 2, lots 4 & 5					1.75	26	1.75	66			700	3 x2		
263	Playfair: Bet. lots 1 & 2, Cons. 2 & 3	1.25	66	1.25	66	1.25	33	2	22			1000	4 x3		
264	Bet. Cons. 5 & 6, lot 12	.25	66	.25	66	.25	33								
265	Bet. Cons.4 & 5, lots 7 to 10					.75	26								
266	Stock: Bet. Cons. 5 & 6, lots 8 to 12	2.5	66	2.5	66										
267	Bet. Cons. 3 & 4, lots 1 & 2					1	33								
268	Taylor: Bet. lots 2 & 3, Cons. 1 & 2							2	re						
269	Bet. Cons. 3 & 4, lot 3	Filling in at rail road cross sing													
270	Bet. Cons. 1 & 2, lots 11 & 12							1	22			200	3 x2		
271	Bet. lot 10 & 11, Con. 2	1	66	1	66	1	33	1	22			400	3 x2		
272	Bet. lots 2 & 3, Con. 3	.75	66	.75	66	.75	33	.75	22			200	3 x2		
273	Bet. Cons. 3 & 4 lots 1 & 2							1	22			400	3 x2		
274	Bet. Cons. 5 & 6, lots 1, 2 & 3	1	66	1	66	1	26								
275	Bet. lots 10 & 11, Cons. 3 & 4					1.75	26								
276	Bet. lots 8 & 9 Con. 3	.88	66	.88	66	.31	26								
277	Bet lots 8 & 9, Con. 6							.5	22						
278	Bet. Cons. 4 & 5, lots 7 & 8							1	re						
279	Walker: Bet. lots 4 & 5, Con. 1 & 2							2	22			400	3 x2		
280	Bet. Cons. 3 & 4, lot 12					.5	33								
281	Bet. Cons. 2 & 3, lots 5, 6 & 7					1.5	26								
282	Bet. lots 10 & 11, Con. 1, and Cons. 1 & 2, lot 11							.63	22						
283	Bet. Cons. 5 & 6, lot 10 11 & 12					1	26								
	BOUNDARY LINES.														
284	Beatty—Carr: Cons. 3 & 4							2	re						
285	Bet. Cons. 1 & 2														
286	Bet. Con. 4													.5	
287	Beatty—Hislop: Lots 8 to 13														
288	Bond—Stock: Lot 3														
289	Bowman—Carr: Lots 5 to 12							4	re						
290	Lots 1, 2 & 3														
291	Bowman—Currie: Cons. 4, 5 & 6.														
292	Bowman—Hislop: Cons. 2, 3 & 4.														
293	Carr—Taylor: Cons. 3 & 4							2	re						
294	Carr—Wilkie: Lots 5 to 10	3	66	3	66	3	26								
295	Clergue—Walker: Cons. 1 & 2							2	re						
296	Currie—Taylor: Lots 2 to 6													2.25	
297	Currie—Taylor: Lots 2, 4, 10 & 12														
298	Lots 1 to 12							6	re						
299	Hislop—Playfair: Lots 1 & 2					1	33								
300	Stock—Taylor: Cons. 2, 3 & 4													1.1	
301	Cons. 1 to 6							6	re						
302	Taylor—Walker: Bet. lots 6, 7 & 8							1.5	22						

NORTHERN DEVELOPMENT BRANCH.

DONE, YEAR 1921.

ushed Rock s.	ushed Rock l. covered	Dragging Miles	Other Rep'rs Miles	Culverts Wood	Culverts Stone or Conc.	Culverts Met.	Culverts Size	Bridges No.	Bridges Description	Remarks	
								1	Repaired.		256
											257
				5			18x4x2	1	16x16x5.		258
				5			16x2x2	2	200x16x10.		259
				6			18x3x2				260
				4			18x3x2				261
				12			16x3x2				262
				10			18x3x2				263
											264
											265
											266
											267
				1			18x4x4				268
											269
				3			18x4x4	1	16x16x4.		270
				4			18x3x2				271
				5			18x4x4	1	20x16x6.		272
				4			18x4x4	1	16x16x6.		273
											274
											275
											276
											277
											278
				12			18x3x2	2	16x16x6.		279
											280
											281
				3			18x3x2				282
											283
											284
		2									285
											286
		3									287
				1			18x4x3				288
											289
		1.5									290
			.25					1	Repaired.		291
		1.5									292
											293
											294
											295
											296
				2			16x4x2				297
				4			18x6x4	1	16x6x6.		298
											299
											300
											301
				4			18x4x4				302

DEPARTMENT OF LANDS AND FORESTS.

ANNUAL REPORT OF WORK

MATHESON DISTRICT.

	TOWNSHIP—LOCATION	Cutting		Burning		Stumping and Grub'g		Grading		Cross Lay		Ditching			Gravellir	
		L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L ft.	W & D		L mls.	yd us
	LATCHFORD—COCHRANE TRUNK ROAD.															
303	Bowman: Cons. 5 & 6	Was	hout	s		filled	at	culver	ts	and	br	idge a	ppro	ches.		
304	Carr: Cons. 1 & 2							2	re						1	
305	Lot 10, Con. 2	Gra	de s	red	uc	ed on	a	pproac	he	s to	W	ahtay	beag		Bridg	e
306	Hislop: Cons. 4 & 5	Was	hout	s		filled	at	culver	ts	and	br	idge a	ppro	ches.		
307	Lots 6, Con. 1															
308	Lot 11, Con. 4															
309	Lot 13, Con. 5															
310	Con. 1							1	30							
311	Playfair: Cons. 5 & 6							2	30			800	3	x2		
312	Lot 4, Con. 4											450	5	x3½		
313	Taylor: Lot 1, Con. 3														5	
314	Cons. 3 & 4							2	re							
	MUSKOKA DISTRICT.															
315	Road from Severn Bridge to North Bay							8.5	18	1		500	2	x1½		2
								.25	24			560	5	x4		
								1.5	22			500	4	x3		
								9.	20			330	3	x2		
								5.6	fo	r	cr	ushed	s	tone.		
316	Rd. from Utterson to Parry Sound	Und	er	brus	hi	ng			.25	16		1320	2	x1		
317	Rd. from Huntsville to Dwight	3						12		20						
318	Gravenhurst Sanitorium Road	.25	66	.25	66	.25	26		.33	26						
319	Rd. from Gravenhurst to Bala	4.5	24	4.5	24			2		18		1915	2	x1		
								3		20						
320	Bala-Parry Sound, Footes Bay to Gordons Bay	Bru	sh	ing												
		.5	35			.25	40	.7	16	.01	16					

NORTHERN DEVELOPMENT BRANCH.

DONE YEAR, 1921.

ushed Rock		Drag-ging Miles	Other Rep'rs Miles	Culverts				Bridges		Remarks	
s. h-	L. cov-ered			Wood	Stone or Conc.	Met.	Size	No.	Description		
											303
											304
											305
											306
								1	Repaired.		307
								1	Repaired.		308
								1	Repaired.		309
											310
				8			18x4x4				311
											312
											313
											314
		30				1 Steel	20′6″x18″			357 c.yd. rock fill.	315
						1 "	20′6″x14″			1147 c.yd. earth fill.	
						1 "	26′x36″			180 c.yd. excavation.	
						2 "	20′x14″	1	10′.	450 rods fencing erected.	
51½	5.6					1 "	46′x15″	2	14′x 16″.		
						1 "	30′x16″				
						2 "	20′x16″				
						1 "	12′x18″				
						1 "	20′x12″				
						2 "	22′x 8″				
					1Stone		13′x 20″x16				
					1 "		16′x 16″x14				
					2 "		18′x 22″x16				
					1 "		21′x 24″x24				
					1 "		26′x 30″x30				
				1			32′x 18″x18				
				1			22′x 48″x48				
				1			23′x 14″x14				
				1			20′x 24″x20				
				1			22′x 36″x31				
				1			20′x 12″x12				
				1			22′x 48″x6				
										1625 c.yds. earth excavation & fill in approaches to Skeleton River Br.	316
				6	repaired						317
						10Steel	20′x10″				
				20			16′x 20″x12				
										150 c.yd. earth filling.	318
		1.25				1 Steel	18′x 24′			100 rds. fencing erected.	319
						3 "	26′x 20′			836 c.yd. earth filling.	
						3 "	19′x 10′			122 c.yd. stone.	
						1 "	16′x 10′				
						7 "	25′x 10				
						1 "	18′x 10′				
					1Stone		16′x 12″x8″				
				7			16′x 16″x8″				
				6			14′x6″x6″				320

DEPARTMENT OF LANDS AND FORESTS,

ANNUAL REPORT OF WORK

NIPISSING-SUDBURY DISTRICT.

	Cutting		Burning		Stumping and Grub'g		Grading		Cross Lay		Ditching		Gravellin	
	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L ft.	W & D	L mls.	yd use
Trunk Road from Pembroke to Sudbury:														
321 Pembroke to Petawawa													4	16
													6	7
322 Chalk River westwards	6.5		6.5		6.5		6.5				6107			
323 Stonecliff to Deux Rivieres									Rep ai		red.			
324 Deux Rivieres to Klocks	5.5		5.5		5.5		5.5				600			
325 Klocks to Mattawa														
326 Callander to North Bay:														
(Callander Westwards)											1600		4.5	
(North Bay Eastwards)													3.5	5.
327 North Bay to Sturgeon Falls											400		10	
											5200	cleare	d 2	1
							3.5	re					3.5	2
328 Sturgeon Falls to Verner							8	re						
329 Verner to Warren													5	3
330 Wahnapitae, Eastwards													4	
331 Coniston to Sudbury														
332 Minessing Road, Algonquin Park									270	16	7920	2 x1½		
Trunk Road, North Bay Northwards:														
333 I.—North Bay to Feronia														
334 II.—Feronia to Widdifield					3.5	26	3.5	24						
335 Trunk Rd., Sturgeon Falls to Field							.5	re					.5	
					2.5		2.5						2.5	1
336 Sturgeon Falls—Field Road to Smoky Falls							2.75						2.25	1
337 Warren—St. Charles Road														
338 St. Charles—Noelville Road							2.75				1000			
339 Hagar—St. Charles Road					3.5		3.5				1000			
340 Sudbury—Azilda—Chelmsford Rd							1.5	re					1.5	1
							.75	re					.75	
													4	2.
341 Sudbury—Long Lake Road							1.25	re						
342 Rutter—Noelville Road							7.5	re					7.5	5.
343 Coniston—Garson Road													2.5	1.
Trunk Road, Sudbury to Milnet:														
344 I.—Sudbury to Hanmer							1.5	re						10
345 II.—Hanmer to Capreol							2.	re						
346 III.—Capreol to Milnet	1.5	66	1.5	66	3	26	2.5	re						
347 Road to West Shining Tree					5.5	16	3	24	.4	8			5.5	wi

NORTHERN DEVELOPMENT BRANCH.

Done, Year 1921.

Crushed Rock		Dragging Miles	Other Rep'rs Miles	Culverts				Bridges		Remarks	
ls. sh-d	L. cov-ered			Wood	Stone or Conc.	Met.	Size	No.	Description		
		6		cl	eaned	out				1 mile sidebrushing.	321
			14	cl	eaned	out				Washouts repaired.	322
				9	3	6					
			18							Boulders removed from waggon track, overhanging trees and branches removed.	323
				10		4					324
			14	2	repaire d						325
		4.5		1				1	Repaired.	2.5 miles sidebrushed.	326
										10 miles sidebrushed.	327
		9								Creek cleared out.	
								3	Re-covered.		
											328
			11		1	1					329
								1	Repaired.		330
			8		clean	ed out					331
				4			14x2x2			2330 c.yd. of surfacing material placed on road.	332
				22			14x8				
			6	2	repaire d						333
				24	2			2	25′ span.	1500 c.yd. hill cutting.	334
					repaire d		(Old road)				335
				4	3	3	(Newroad)			5 mile sidebrushed.	
				8							336
gen	eral	repairs									337
				8	rebuilt						338
				10				1	20′span.	350′ fill, 3′ deep.	339
											340
				6		2				Road widened at bad curve.	341
				5		16					342
											343
											344
										1 mile sidebrushed.	345
											346
				27							347

DEPARTMENT OF LANDS AND FORESTS.

ANNUAL REPORT OF WORK

PARRY SOUND DISTRICT.

		Cutting		Burning		Stumping and Grub'g		Grading		Cross Lay		Ditching		Gravellir	
		L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L ft.	W & D	L mls.	yd use
348	Rd. from Severn Br. to North Bay.							14.91	18			300	3 x2		1 250
								9.5	15			140	2 x1		
								1	22			1146	3 x2½		
								8	20			800	2 x1½		
												300	1½x1		
349	Powassan—Chisholm Road							4.5	22						
350	Powassan—Nipissing Road							8	18			100	2 x2		
351	Nipissing—Restoule Road	Brush hing.													
		2										495	1½x1½		1
		.1	66	.1	66	.1	66	7.25	22			1014	3 x1		
												1849	2 x1½		
352	Powassan—Restoule Road: (Christian Valley)	1.5	66	1.5	66	1	26	1	24			188	2 x1½		
												500	4 x1½		
												225	2½x1		
353	Trout Creek—Commanda Road	6	66	6	66	4.5	26	2	24	.03	12	3924	cleared		2
								2	22			150	5 x5		
												660	2 x1		
												6	272x1		
												2250	1½x1½		
												1000	2 x1½		
354	Burks Falls—Maganatawan Road	4.5	66	4.5	66	5	26	4	25			8900	3 x2½		1 2
												9240	4 x2½		
												2340	3 x1½		
												4350	5 x1		

NORTHERN DEVELOPMENT BRANCH

DOCT. YEAR 1921.

Crushed Rock		Dragging Miles	Other Rep'rs Miles	Culverts				Bridges		Remarks	
Rds. Brush-ed	L. cov-ered			Wood	Stone or Conc.	Met.	Size	No.	Description		
		143.50		2			22x24x24			10560 ft. ditches cleared, stone walls 134'x4'x3'.	348
				1			18x48x24				
				2			18x36x24			421 c.yd. stone fill.	
				3			16x36x24			860 c.yd. earth fill.	
				1			16x24x12			1624 c.yd. cinders on road	
				7			16x48x48				
				1			18x48x24				
				1			18x48x36				
				1			covered				
					1		20x36x24				
					1		16x24x24				
					1		16x72x24				
					1		14x24x24				
					1		16x24x24				
						4	26x30				
						1	24x30				
		2.50		2			18x48x24				349
		6								3 c.yd. stone fill.	350
		7.50		5			repaired	1	Repaired.	4 c.yd. stone fill.	351
					2		18x8x2				
					13		18x3x2			Stone wall, 196'x 8.	
					2		18x4x4			Stone wall, 528'x 4.	
					4		18x2x2				
				5			18x3x2				
				8			18x4x4				
				15			18x3x2				
		2.25		2			(subways)			$\frac{1}{4}$ mile filled 2 feet deep.	352
				2			22x4x2			Grade reduction, 300'x4'.	
				1			24x5x3			Stone wall, 300'x5x3.	
				3			26x3x3			250 c.yd. excavation,	
				2			13x2$\frac{1}{2}$x1			400 c.yd. embankment.	
		13				1	14'x 18"	1	Repaired.	2050 c. yd. filling.	353
						3	20'x 24"			52 c. yd. stone fill.	
						2	20'x 12"			6200 c. yd. excavation.	
						1	18'x 12"			Side hill cutting.	
				5			18x3x3			$\frac{1}{4}$ mile x 6'.	
				1			30x6x4				
				1			28x5x4				
				4			18x3x3				
				1			24x6x3				
				1			24x5x3				
				1			19x4x2$\frac{1}{2}$				
				9			18x3x3				
				9			16x3x3				
				1			30x6x6				
				1			24x3x3				
						1	26x3x3				
						3	24x3x3				
		3.50		8			26x4x2			3494 c. yd. excavation.	354
				11			22x4x4			1876 c. yd. embankment.	
						1	24x4x4			204 c. yd. earth fill.	
										71 c. yd. stone fill.	
										.17 mile brushed out.	

DEPARTMENT OF LANDS AND FORESTS.

ANNUAL REPORT OF WORK

PARRY SOUND DISTRICT.

		Cutting		Burning		Stumping and Grub'g		Grading		Cross Lay		Ditching		Gravelling	
		L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L ft.	W & D	L mls.	yds used
355	Gravenhurst—Bala-Parry Sound Road	.25	40	.25	40	.5	40	1.2	16			6900	3 x2		
	PORCUPINE DISTRICT														
	Township Location														
356	Dundonald: Bet. 6 & 7, Cons. 3, 4 & 5	3	66	2.5	66	2.5	24								
357	Matheson: Bet. lots 6 & 7, Cons. 6 & pt. 5											14340			
358	Mountjoy: Bet. lots 4 & 5, N. of Mattagami River														
359	Mountjoy: Bet. lots 4 & 5, N. of Transmission Line	.5	66	.5	66	.5	24					3100			
360	Transmission Line lots 4 & 5, to Sandy Falls					3.5	24					36295			
361	Bet. lots 8 & 9, Cons. 2, 3 & 4							3	24	105	16	394			1.
362	Shaw: To "Tommy Burns" Mine.	6.5	24	6.5	24	6.5	24								
363	Tisdale: Trunk Rd., McIntyre Hill													.125	2(
364	Tisdale & Delora to "Anchorite" Mine	1.5	66	1.5	66	2.75	24	.14	24	375	16	4200			
	BOUNDARY LINES.														
365	Delora—Ogden											450		.5	4(
366	Delore—Shaw: S. Porcupine, 3 miles south														1.
	TRUNK ROAD.														
367	Porcupine to Porquois Junctin	24.9	66	16.6	66	24.9	30	24.9	30						...
	RAINY RIVER DISTRICT.														
	Townships Location														
368	Aylesworth: River Rd., lots 15-21.													.75	
369	Barwick: Trunk Road, across Manitou Reserve; also lots 1-8 & 12											7920		3.5	
370	Blue: Bet. Sec. 34 & 35													.5	
371	Burriss: Bet. lots 8 & 9, Con. 1.													.75	
372	Carpenter: Bet. lots 6 & 7, Cons. 4 & 5														1.2
373	Crozier: R.R. lots 1-5 and bet. Sec. 15 22, 21 22 & 21 28											2640		2.5	
												18480			
374	Curran: Lots 1 to 8 and 11 to 14													1.5	
375	Dance: Bet. lots 8 & 9, Cons. 1 & 2	2	Br	ushed				2				10560			
376	Devlin: Bet. Sec. 4–5, 8–9, 20–21, 28–29, 32–33, 29–32, 26–27, 22–27 & 22–23														

NORTHERN DEVELOPMENT BRANCH.

DONE, YEAR 1921.

Crushed Rock		Dragging Miles	Other Rep'rs Miles	Culverts				Bridges		Remarks	
Ls.	L. covered			Wood	Stone or Conc.	Met.	Size	No.	Description		
				3			12x1½x1½				355
				4			16x10x6				
											356
											357
		4						5	Repaired.		358
											359
		1		8			18x5x2	1	229x18x5.	300 yds. surfaced with loam.	360
				1			13x10x3				361
											362
800											363
				2			18x5x2	1	18x16x4.	3196 c. yds. filling.	364
				1			18x15x4	1	18x10x4.		
				1			18x8x2	1	25x18x4.		
								1	20x18x4.		
											365
				9			16x6x2	1	102x16x4.		366
								1	51x16x4.		
								1	25x16x4.		
								1	20x16x4.		
											367
											368
										¾ mile widened.	369
				1							370
											371
											372
				7							373
											374
				2							375
				5							376

DEPARTMENT OF LANDS AND FORESTS,

ANNUAL REPORT OF WORK

RAINY RIVER DISTRICT.

TOWNSHIP—LOCATION	Cutting		Burning		Stumping and Grub'g		Grading		Cross Lay		Ditching		Gravelling	
	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L ft.	W & D	L mls.	yds used
377 Dilke: Bet. Sec. 34–35													.63	
378 Trunk Rd., lots 17 to 24, and across lots 9, 12, 15, 37, 38, 39 west of 48													2.25	
379 Dobie: East Townline, Cons. 1 to 5													3	
380 Lash: Trunk Road, bet. Sec. 26–35, 27–34, 28–33, south of Sec. 32											2640 15840		2.5	
381 Bet. Sec. 26–27	.5		.5		.5									
382 Morley: Trunk Rd., across Indian Reserve, and bet. lots 10–11, 10–15, 9–16, 8–17, 7–18, and west of Sec. 18													5.5	
383 Morley: Bet. lots 8–17, & R.R. 53–54											7920			
384 Mather: Bet. Cons. 5 & 6, lots 7 & 8, and bet. lots 6 & 7, Con. 6													2	
385 East Townline, Cons. 1 to 3													1	
386 McCrossin: Across Cons. 1 & 2													1	
387 Bet. Cons. 2 & 3, lot 3					.25		.25							
388 McCrossin—Tovell: Townline, Cons. 5 & 6	.5		.5		.5		2							
389 McIrvine: Bet. Sec. 29–30, 31–32, across lots 45 to 48											4290		1.5	
Indian Mission Road							1.25							
391 Miscampbell: Bet. lots 8 & 9, Cons. 1 & 2, and south of lots A B & C	1		Brush ing				1						3	
392 Morson: Bet. lots 12 & 13, Cons. 1 & 2							2							
393 Nelles: Bet. Sec. 2 & 3													.5	
394 Bet. Sec. 8 & 9													.5	
395 Bet. Sec. 26–27 & 34–35											10560			
396 West of Sec. 25											3960			
397 Patullo, Bet. Sec. 21–22, 27–28, 33–34													1.75	
398 East of Sec. 13							1							
399 East of Sec. 25 & 36	1.5		1.5		1.5									
400 Potts: Bet. lots 2 & 3, Cons. 3 to 5							1.5							
401 Pratt: Across Cons. 1 & 2, and Cons. 5 & 6													2	
402 Richardson: Bet. Cons. 1 & 2, lots 5 to 8							2							
403 Shenston: Across Indian Reserve south of Sec. 1 & 2, east of Sec. 1 & 12													2.5	
404 From Trunk Road, north to connect with road bet. 28 & 29	1.75		1.75											
405 Sifton: Bet. lots 8 & 9, Con. 2	1		Brush in g		1						5280			
406 Spohn: Bet. lots 4 & 5, Cons. 3 to 5													2.25	
407 Bet. Sec. 13–14 & 21–22													1	
408 North of Sec. 2 to 5							3.5				18480			
409 South of 42, 43 & 44							3				15840			
410 Across Sec. 27											3960			
411 Across lot 10, Con. 3											3300			

NORTHERN DEVELOPMENT BRANCH.

Done, Year 1921.

Crushed Rock		Dragging Miles	Other Rep'rs Miles	Culverts				Bridges		Remarks	
Yds. Crushed	L. covered			Wood	Stone or Conc.	Met.	Size	No.	Description		
											377
											378
				5				2	Repaired.		379
											380
											381
											382
				7							383
											384
				2				1	45′ pile bridge.		385
											386
											387
				4							388
											389
				3							390
				6							391
				6							392
											393
											394
											395
											396
											397
											398
											399
				5							400
											401
											402
											403
											404
											405
											406
											407
											408
											409
											410
											411

DEPARTMENT OF LANDS AND FORESTS.

ANNUAL REPORT OF WORK

RAINY RIVER DISTRICT.

	TOWNSHIP—LOCATION	Cutting		Burning		Stumping and Grub'g		Grading		Cross Lay		Scarifying		Gravelling	
		L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L ft.	W & D	L mls.	yds used
412	North of Sec. 2 & 3, and across lots 13 & 14	2		2											
413	Bet. Sec. 19–27	.75		.75											
414	Trunk Road, Rainy River to Harris Hill														
415	Sutherland: Bet. lots 6 & 7, Con. 1											2640			
416	Tait: West of Sec. 24													.5	
417	Tovell: Bet. Cons. 2 & 3, lot 7							.5				2640			
418	Con. 2 & 3, lots 5 & 6											5280			
419	Bet. lots 6 & 7, Cons. 2 & 3											2640			
420	Across lot 7, Con. 2											825			
421	Bet. Cons. 2 & 3, lots 5, 6, & 7	1.75		1.75											
422	Woodyatt: Across Indian Reserve													1	
423	Bet. Sec. 32–33													.5	
424	Worthington: Trunk Road, south Sec. 31, 32, 34, 35 & 36													2	
425	Rainy River to Fort Frances														
426	Spohn Trunk Road														
427	Sleeman—Bergland Road														
428	Emo—Offtake Road														
429	Devlin-Big Fork Road														
	THUNDER BAY DISTRICT.														
430	Crooks & Pardee: Pine River to Minnesota Boundary	4.5	side brushed									390		2.75	
431	Crooks & Blake: Jarvis River to Pine River	11		do										.75	16
432	Paipoonge: Bet. Cons. 4 & 5, lots 1 to 15	.75		do											6
433	Neebing: Lot 11					34	4 t. fence erected on approaches to bridge.								
	SILVER MOUNTAIN ROAD.														
434	Paipoonge: Across lots 1 to 7 O'Connor, Townline to Silver Creek	2.5		do				3.5	re			2445		1	8. 17
435	Paipoonge: Arthur St. to C.N.R.							.5	re						
436	Gillies: Across lots 7 to 10	2		do				2				854	x3		
437	Bet. lots 10 & 11, Cons. 4 & 5	.75	45	.75	45	.75	28	.75	16						
438	Sellers to Morgan	.75	66	.75	66	.75	26	.75	22			1600			
439	Lybster: Morgan North-westwards	.75	50	.75	50	.75	26	.75	16					.75	
	KAKABEKA HYMERS ROAD.														
440	Oliver			300 feet road widened from 14 feet to 24 feet.											
441	O'Connor: Bet. Cons. 6 & 7, lots 2 to 5	2	side brushed					2	re			300		2	200
442	Bet. lots 6 & 7, Cons. 4 & 5							1.63	re					1.63	141
443	On lot 6, Con. 1													.25	28
444	Gillies: On lot 6, Con. 6													.25	2

NORTHERN DEVELOPMENT BRANCH.

Done, Year 1921.

Crushed Rock		Dragging Miles	Other Rep'rs Miles	Culverts				Bridges		Remarks	
Yds. crushed	L covered			Wood	Stone or Conc.	Met.	Size	No.	Description		
											412
											413
											414
				5							415
											416
											417
											418
											419
											420
											421
											422
											423
				6							424
		65									425
		15									426
		18									427
		10									428
		7									429
		18		18 3 repaired	cedar	& pine		1	Repaired.	36500 c.yds. earth excavated for road widening. 680′ heavy fence and handrailing.	430
		11		2		2		2		200 c. yds. earth excavated for road widening.	431
		3.75		2							432
		.12									433
shale											
gravel				31							434
											435
		2	.5		3						436
				7	1					Side hill cut, 300′ long.	437
											438
				4						Side hill cut, 0.75 miles.	439
				1	replaced		18x6x4			2000 c.yd. excavation & fill	440
				6						2 creeks straightened.	441
				1							442
										Side hill cut, 150′ long.	443
										1500 c. yd. side hill excavation.	444

DEPARTMENT OF LANDS AND FORESTS,

ANNUAL REPORT OF WORK

THUNDER BAY DISTRICT.

	TOWNSHIP—LOCATION	Cutting		Burning		Stumping and Grub'g		Grading		Cross Lay		Ditching		Gravelling	
		L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L ft.	W & D	L mls.	yds used
	HYMERS—SOUTH GILLIES ROAD.														
445	South Gillies: Hymers Hill													.15	
446	Cons. 2 & 3	1		si	debr	us	hed.		1.5	22		501			135
	SUNSHINE ROAD.														
447	Conmee: Bet. lots 4 & 5 Cons. 5 & 6	1.63	66	1.63	66	1.632	8								
448	Bet. Con. "A" & lot 1														
	SOUTH GILLIES—PEARSON ROAD.														
449	Gillies: Bet. lots 6 & 7, Con. 1 & Pearson, across Cons. 3, 4, 5 & and lots 19 & 20	3		si	debr	us	hed.		5	22		2400			
450	Pearson: Bet. lots 22 & 23, Con. 2											2000			
	ROAD FROM DONA BRIDGE TO FORBES TOWNSHIP.														
451	Dawson Road lots, Dona Bridge to lot 2	2	40	2	40	2	26	.5	22						
452	To South Boundary, Forbes Boundary line across lot 13														
	Forbes: Bet. lots 12 & 13, Con. 1	2.25	66	2.25	66	2.25	26								
	SCOBLE ROAD.														
453	Blake—Scoble Boundary, Cons. 1, 2 & 3, Scoble, lots 1 to 2							8	22			900		3	15
454	Gillies: Bet. Cons. 1 & 2, lots 1 to 6														
	PEARSON—PARDEE ROADS.														
455	Pearson: Bet. lots 6 & 7, Cons. 1, 2 & 3	2.5	66	2.5	66	2.5	28					600	3 x2½		
												600	6 x2		
456	Pearson: Bet. lots 11 & 12, Cons. 1, 2 & 3	1.5	16	1.5	16	1.5	28	1.75	22			1 450	3 x2½		
	ROAD ON BLIND LINE CONMEE.														
457	Conmee: Across lots 1 to 6, Con. 1, and bet. lots 6 & 7, Con. 1	3.5		si	debr	us	hed.		3.5					3.5	259
	ARTHUR STREET ROAD.														
458	Paipoonge: Fort William to Kakabeka			R	oad	w	ay ma	in	tained	an	d ke	pt	in ge	neral	repair.
	PORT ARTHUR—NEPIGON ROAD.														
459	McGregor: Port Arthur eastwards	8		si	debr	us	hed.					11488	3½x2	8	56
460	McKenzie River to Sibley	3.5		se	cond	g	rowth					21620			5
															19

NORTHERN DEVELOPMENT BRANCH.

Done, Year 1921.

Crushed Rock		Drag-ging Miles	Other Rep'rs Miles	Culverts				Bridges		Remarks	
Yds. Bush-ed	L. cov-ered			Wood	Stone or Conc.	Met.	Size	No.	Description		
					1		84'x 18"			600' heavy guard rail.	445
				3	1						446
											447
								1	14' wide.		448
				29							449
										5 mile clay surfaced.	450
				2							451
											452
								1	16x13x3.		
				33		7	repaired	1	16x10x4.		453
			3								454
											455
				9				1	16'x 7'.		456
		3.5		3							457
		11									458
		8				42				315 c. yd. stone in road foundation.	459
Sand gravel				35						1200 c. yd. stone in road foundation.	460

DEPARTMENT OF LANDS AND FORESTS.

ANNUAL REPORT OF WORK

THUNDER BAY DISTRICT.

	TOWNSHIP—LOCATION	Cutting		Burning		Stumping and Grub'g		Grading		Cross Lay		Ditching		Gravelling	
		L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L ft.	W & D	L mls.	yds. used
461	Sibley eastwards	4.5	40	4.5	40	4.5	28								
462	At McKenzie River														
	DAWSON ROAD.														
463	McIntyre: Port Arthur to lot 27, Con. "A," Dawson Rd. lots	8	slid	ebru	sh	ed.		8	24			3500		1	
464	Oliver & Ware: McIntyre Tp. to Kaministikwia	5.5		do.								31680	3 x1½	9	244
	JOHN ST. ROAD.														
465	McIntyre & Oliver: Port Arthur—Kam River	8		do.								31680	3 x1½		
	OLIVER ROAD.														
466	McIntyre & Oliver: Port Arthur—Kakabeka	8		do.								22720	3 x1½		
	CURRENT RIVER ROAD														
467	McIntyre & Gorham: Along Current River to line bet. Cons. 3 & 4, Gorham	1.25	40	1.25	40	1.25	26	1	22						
	DOG RIVER ROAD.														
468	Ware: Dawson Rd. to lot 20 Con. 6							2.5	22					1	
	DOG LAKE ROAD														
469	Gorham & McIntyre: Dawson Rd to Gorham Ware Boundary on line bet. Cons. 5 & 6	3.5	slid	ebru	sh	ed.						800			126
	COPENHAGEN ROAD.														
470	McIntyre & McGregor — Gorham Boundary: Port Arthur to Con. 3, Gorham	2.5		do.								1170		3	119
	TOWNSHIP WORK.														
471	Dawson Road Lots: Extension of Dawson Road														
472	Bet. Cons. 1 & 2, lots 12 to 15	2		do								5180			180
473	Dorion: Bet. lots 1 & 2, Con. 4							.3				825			
												1650			
474	Ouimet to Coldwater River	1.25		do.								225		.3	
475	Bet. lots 2 & 3, Con. 4							.1				600			
476	Bet. Cons. 3 & 4, Ouimet to lot 9							.5				1200		.38	
477	Brunner Road, Cons. 4 to 6	1		do.								3960		1.5	
478	Bet. lots 10 & 11, and across lots 10 & 11, to corner of lot 9	.7		do.				.25				750		.25	

NORTHERN DEVELOPMENT BRANCH.

Done. Year 1921.

Crushed Rock		Dragging Miles	Other Rep'rs Miles	Culverts				Bridges		Remarks	
Yds. crushed	L. covered			Wood	Stone or Conc.	Met.	Size	No.	Description		
											461
			.25					1	Abutments completed and steel erected.	2000 c. yd. earth fill.	462
				6							463
				10				1	Re-covered.		464
				2 new 6 reapired							465
		21.50									466
			3.06								467
			1.5	16							468
		6		7							469
				3				1 1	16x11x4. 16x16x4.	2 creeks cleared out.	470
			8	repairing						1 hill graded and ditched.	471
				3				1	Repaired.		472
				1							473
				3							474
											475
				7							476
				7							477
								1	Renewed.		478

DEPARTMENT OF LANDS AND FORESTS,

ANNUAL REPORT OF WORK

THUNDER BAY DISTRICT.

	TOWNSHIP—LOCATION	Cutting		Burning		Stumping and Grub'g		Grading		Cross Lay		Ditching		Gravellin	
		L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L mls.	W ft.	L ft.	W & D	L mls.	yd use
479	Bet. Cons. 4 & 5, lots 11 & 12							.008						.008	
480	Bet. Cons. 3 & 4, lots 13 & 14	.13		.13		.13		.13							
481	Bet. lots 12 & 13, Con. 4, and bet. Cons. 3 & 4, lots 9 to 12	.2	s id	ebru	sh ed.			.007						.3	
482	Bet. lots 8 & 9, Con. 3													.3	
483	Bet. Cons. 2 & 3, lots 9 to 13	2	s id	ebru	sh ed.			.1						.2	
484	Gorham: Bet. Cons. 3 & 4, lots 9 & 10	1		40 1		40 1		22 1		16		575			
485	Bet. lots 8 & 9, Cons. 1, 2 & 3	2	s id	ebru	sh ed.										
		.75	40	.75	40	.75	24							2.25	
486	Gorham & Ware Boundary, Cons. 1 & 2	.25	40	.25	40	.25	24					700		2.75	
487	Lybster: Bet. Cons. 1 & 2, lots 1 & 2	1		40 1		40 1		24 1		16					
488	Marks: Bet. Cons. 1 & 2 lots 3 & 8	.2	5	side	br	ushed									
		1	22	1	22	1	22	1	16			1000			
489	Bet. lots 6 & 7, Con. 2	side	br	ushe	d,	grade	d	& culv	erts	ins		talled			
490	Bet. Cons. 2 & 3, lots 3 & 4			do.				do.				do.			
491	Bet. lots 2 & 3, Con. 2			do.				do.				do.			
492	Bet. Cons. 5 & 6, lot 2			do.				do.				do.			
493	Bet. Cons. 6 & 7, lot 1			do.				do.				do.			
494	Marks & O'Connor Boundary, Cons. 6 & 7			do.				do.				do.			
495	Pearson: Bet. Cons. 3 & 4, lots 7 to 11	.5	66	.5	66	.5	26	.2	re			310			
								.5	20			150			
496	Bet. Cons. 4 & 5, lots 1 & 2											150			
497	Bet. lots 9 & 10, Cons. 1 & 2	.25	40	.25	40			.75	16						
498	Bet. Cons. 4 & 5, lots 12 & 13, and bet. lots 12 & 13, Con. 5														
499	Bet. Cons. 2 & 3, lots 9 & 10											130			
500	Schreiber: Schreiber to L. Superior							.25	16			2000		1.12	
501	Scoble: Bet. lots 2 & 3, Con. 1							.5	20						
502	Bet. lots 4 & 5, Cons. 2 & 3	.75	60	.75	60	.75	26	.5	16	.25	12				
503	Scoble & Gillies: Cons. 3 & 4											600		2	
504	Scoble & Paipoonge: Lots 3 & 4	.08	si	debr	us hed.			.25	16					1.25	
505	Sterling & Lyon: Lots 4 & 5									.38	12	1980		.38	
506	Sterling: Bet. Cons. 2 & 3, and bet. lots 2 & 3, Con. 2											1508			
507	Strange: Silver Mt. to Whitefish														
508	Whitefish to West Boundary					1.5	20	.25	16						
509	Ware: Bet. Cons. 3 & 4, lots 1 to 4	1.75	40	1.75	40	1.75	40								
510	Bet. lots 17 & 18, Cons. 2 & 3, and bet. Cons. 3 & 4, lots 13 to 18														
511	Bet. lots 10 & 11, Cons. 1 & 2	3	s id	ebru	sh ed.										

ORTHERN DEVELOPMENT BRANCH.

ONE, YEAR 1921.

hed k	Drag-ging Miles	Other Rep'rs Miles	Culverts				Bridges		Remarks	
l. cov-ered			Wood	Stone or Conc.	Met.	Size	No.	Description		
							1	Re-covered.		479
										480
										481
										482
			5							483
			1							484
				repaired						485
			15							486
										487
		8								488 489 490 491 492 493 494
		2	4							495
		1.25	7							496
		1	1							497
			3						1 hill cut down and rocks removed from roadway	498
			1	replaced			2	Re-covered.		
			1							499
			1	removed						
			4	renewed			1	Repaired.		500
										501
			6							502
			6				2	Raised.		503
										504
										505
			7							506
		5	12	replaced						507
		2	9	replaced						508
										509
		6	25				1	16x16x5.	500 c. yd. rocks removed from road.	510
		3	19				1	Recovered.		511

Appendix No. 46.

NEW LISKEARD DEMONSTRATION FARM.

Work on the Farm during the past year consisted of the production of 120 acres of crop, and in the clearing of approximately 18 acres of new land. On account of not having any farm buildings, it was not considered advisable to carry on any field demonstration work, in the production of a variety of crops. The Farm produced 60 acres of hay, and 60 acres of oats.

Practically all ploughing was done in the fall of 1920, with the exception of 10 or 12 acres of new land; this was ploughed in the spring. Considering the rather adverse growing season, the crops turned out very well.

The seeding of oats was commenced on the 18th of May, and concluded on the 25th. We grew two varieties of oats, viz., O.A.C. No. 72, and O.A.C. No. 3. The O.A.C. No. 3 gave the best results, matured earlier, filled better, and weigh heavier. The No. 3 matured in 75 days from date of seeding. The weight of a cleaned sample of this variety averages 37 pounds to the measured bushel; this is considered to be exceptionally good for the past year. On account of having such a large crop, and owing to the necessity of having to stack same, I deemed it advisable to sell 30 acres, standing in the field; this left 30 acres to be taken off by the farm.

We commenced cutting hay on the 10th of July, and before we had it finished, we commenced cutting our O.A.C. No. 3 oats. The hay gave an exceptionally good yield, especially the first cut of new hay, which was approximately all clover. The entire 60 acres would average a ton and a half per acre.

The oats did not yield quite as well as last year, on account of drought, the total yield being about 1,800 or 2,000 bushels.

About 40 acres of land have been ploughed this fall, for next year's crop. This leaves us with between 90 and 100 acres of hay crop for next year.

I would urgently recommend that farm buildings be erected next year, and that the farm be properly equipped with a small herd of good cattle, and a few hogs.

I am firmly convinced that the farm can be made to fill a very important need in this part of the district. Every year the Government distributes more or less seed grain through this part of Northern Ontario, and it only seems reasonable that the major part of this supply might be grown on the New Liskeard Farm.

It is impossible, however, to carry on work of this kind successfully without farm buildings.

Short Course and Seed Fair.

As in past years, the farm has co-operated with the Department of Agriculture in providing accommodation in the judging pavilion for holding a Short Course and Seed Fair.

Our Short Course and Seed Fair was conducted last year in co-operation with the International Harvester Company; Messrs. O'Grady Bros., of New Liskeard, are agents for this firm. The course lasted four days, and we had an attendance of from 100 to 150 each day. Following is a list in connection with with the short course and Seed Fair:

CLASS 1—OATS.

Section 1—1 bus. O.A.C., No. 3 Oats—
1st, $3.50; 2nd, $2.50; 3rd, $1.50; 4th, 50c.

Section 2—1 bus., O.A.C., No. 72—
1st, $3.50; 2nd, $2.50; 3rd, $1.50; 4th, 50c.

Section 3—1 bus., Banner Oats—
1st, $3.50; 2nd, $2.50 ; 3rd, $1.50; 4th, 50c.

Section 4—1 bus., Any other variety (White)—
1st, $3.50; 2nd, $2.50; 3rd, $1.50; 4th, 50c.

CLASS 2—WHEAT.

Section 1—1 bus., Marquis Spring Wheat—
1st, $5.00; 2nd, $4.00; 3rd, $3.00; 4th, $2.00; 5th, $1.00; 6th, 50c.

CLASS 3—BARLEY.

Section 1—1 bus. Any six-rowed Variety.—
1st, $3.50; 2nd, $2.50; 3rd, $1.50; 4th, 50c.

CLASS 4—PEAS.

Section 1—1 bus., Large Field Pea—
1st, $3.50; 2nd, $2.50; 3rd, $1.50; 4th, 50c.

Section 2—1 bus., Small Field Pea—
1st, $3.50; 2nd, $2.50; 3rd, $1.50; 4th, 50c.

CLASS 5—GRASSES.

Section 1—½ bus., Red Clover Seed—
1st, $3.50; 2nd, $2.50; 3rd, $1.50; 4th, 50c.
Section 2—½ bus., Alsike Seed—
1st, $3.50; 2nd, $2.50; 3rd, $1.50; 4th, 50c.
Section 3—½ bus., Timothy Seed—
1st, $3.50; 2nd, $2.50; 3rd, $1.50; 4th, 50c.

CLASS 6—FLAX.

Section 1—½ bus., Flax Seed—
1st, $3.50; 2nd, $2.50; 3rd, $1.50; 4th, 50c.

CLASS 7—POTATOES.

Section 1—1 bus., Irish Cobbler Type—
1st. $4.00; 2nd, $3.00; 3rd, $2.00; 4th, $1.00; 5th, 50c.

Section 1—1 bus., Green Mountain Type.
1st, $4.00; 2nd, $3.00; 3rd, $2.00; 4th, $1.00; 5th, 50c.

PROGRAMME FOR AGRICULTURE SHORT COURSE AND SEED FAIR.

March 29th—1.15 p.m. to 3.00 p.m.
H. G. Bell, B.S.A., Toronto, Ont.
Subject—Soils, Fertilizers and Soil Cultivation.

March 30th.—3.00 p.m. to 4.30 p.m.
J. W. Clarke, Cainsville Ont.
Subject—Production of Registered Seed.

March 31st—1.15 p.m. to 3.00 p.m.
Jno. Gardhouse, Weston, Ont.
Subject—Dairy and Dual Purpose Cattle.

April 1st—1 30 p.m. to 3.00 p.m.

W. H. J. Tisdale, B.S.A., Toronto, Ont.
Subject—Co-operative Grading and Marketing of Wool.

3.00 p.m. to 4.30 p.m.

Geo. H. Barr, Chief of Dairy Division, Ottawa, Can.
Subject—Dairying and Creamery Work, Annual Creamery Meeting.

EVENING LECTURES.

March 31st—7.45 p.m.

J. W. Clarke, Cainsville, Ont.
Subject—Lecture, Vegetable Growing—(Moving Pictures).

April 1st—7.45 p.m.

J. W. Clarke, Cainsville, Ont.
Subject—Lecture and Demonstration on Poultry—(Moving Pictures).

List of Prize Winners, as follows:

CLASS 1—OATS.

Oats—O.A.C., No. 3—

1st, Chas. H. Thomas, Uno Park, Ontario.
2nd, J. R. Philp, R. R. 1, New Liskeard, Ontario.
3rd, Jno. Winnesheimer, R. R. 1, Thornloe, Ontario.

Oats—O.A.C., No. 72—

1st, Geo. C. Foster, Uno Park, Ontario.
2nd, W. R. Peters.
3rd, W. Hermiston, Uno Park, Ontario.
4th, W. A. Reid, Earlton, Ontario.

Oats—Banner—

1st,
2nd, Jas. Carter.

Oats—Any other Variety—

1st, Chas. Thomas, Uno Park, Ontario.
2nd, Bruce Irvine, Hanbury, Ontario.

Oats—Any other Variety—

1st,
2nd,
3rd, W. Hermiston, Uno Park, Ontario.

Sweepstakes in Oats—Chas. Thomas, Uno Park, Ontario.

CLASS 2—WHEAT

Wheat, Marquis Spring—

1st, W. A. Reid, New Liskeard, Ontario.
2nd, J. R. Philp, R. R. 1, New Liskeard, Ontario.
3rd, J. M. Gray, New Liskeard, Ontario.
4th, Jas. Carter, New Liskeard, Ontario.
5th, R. Parker, New Liskeard, Ontario.
6th, Chas. Thomas, Uno Park, Ontario.

Sweepstakes in Wheat—W. A. Reid.

CLASS 3—BARLEY.

Any six-rowed Variety—

1st, Geo. C. Foster, Uno Park, Ontario.
2nd, W. A. Reid, Earlton, Ontario.
3rd, R. Parker, New Liskeard, Ontario.
4th, R. H. Nickle, Hanbury, Ontario.

CLASS 4—PEAS.

Peas, Large Field—

1st, Chas. H. Thomas, Uno Park, Ontario.
2nd, J. R. Philp, R. R. 1, New Liskeard, Ontario.
3rd, T. H. Nickle, Hanbury, Ontario.
4th, W. A. Reid, New Liskeard, Ontario.

Peas, Small Field

1st, Chas. Thomas, Uno Park, Ontario.
2nd, J. M. Gray, New Liskeard, Ontario.
3rd, Jas. Carter, New Liskeard, Ontario.
4th, Albert Brooks.

Sweepstakes in Peas—Chas. Thomas, Uno Park, Ontario.

CLASS 5—GRASSES.

Seed, Red Clover—

No entries.

Seed, Alsike

1st, J. R. Philp, R. R. 1, New Liskeard, Ontario.
2nd, Jno. Winnesheimer, R. R. 1, Thornloe, Ontario.
3rd, W. A. Field, Earlton, Ontario.
4th, J. M. Gray, New Liskeard, Ontario.

Sweepstakes in Alsike Seed—J. R. Philp, New Liskeard, Ontario.

Seed, Timothy—

1st,
2nd,
3rd, Jas. Carter, New Liskeard, Ontario.

CLASS 6—FLAX.

Flax Seed—

1st, Chas. Thomas, Uno Park, Ontario.
2nd, J. R. Philp, R. R. 1, New Liskeard, Ontario.
3rd, Geo. C. Foster, Uno Park, Ontario.
4th, J. M. Gray, New Liskeard, Ontario.

CLASS 7—POTATOES.

Potatoes, Irish Cobbler Type—

1st, Chas. Thomas, Uno Park, Ontario.
2nd, T. H. Nickle, Hanbury, Ontario.

Potatoes, Green Mountain Type—

1st, Geo, Walsh. New Liskeard, Ontario.
2nd, W. A. Reid, Earlton, Ontario.
3rd, Jno. Sharp, New Liskeard, Ontario.
4th, J. M. Gray, New Liskeard, Ontario.

AMOUNT OF PRIZE MONEY PAID OUT..... $90.50

In conclusion, I wish to state that the Farm has had a quite successful year, and has produced a very creditable crop, in view of the rather indifferent growing season. One point I overlooked in speaking of our farm crops, was our second growth crop of clover. We cut 30 acres of second crop, which averaged about a ton per acre. It was one of the best second growth crops of hay that I have ever seen.

All of which is respectfully submitted.

W. G. NIXON,

Agricultural Representative

ONTARIO GOVERNMENT CREAMERY.

New Liskeard, Ont., November 10th, 1921.

Honourable Beniah Bowman,
Minister of Lands and Forests,
Parliament Buildings, Toronto, Ontario.

Dear Sir,—I beg to enclose report of Creamery operations for the year ending October 31st, 1921. While the amount of business done in the winter months was somewhat disappointing, nevertheless we had a nice increase in the amount of cream received during the latter six months. We took in a great deal more than a year ago.

There was one noted difference in the past year after the first of May, and that was the drop in the price of butter in one week of twenty cents per pound. The difference between the lowest prices of fat last year and this year was twenty-two cents per pound. The lowest last year was fifty-five cents, and this year thirty-three. We had two hundred and thirty-six patrons the past year, ranging in herds of cows from two to twenty. There have been a few silos gone up the past summer, and prospects are for some more again this coming year. There were some very good crops of corn and sunflowers grown this year, and the second clover was exceptionally good, which kept the cows in a good thrifty condition, and will no doubt help materially in giving extra milk for the coming winter. During the past year, we received 297,567 pounds of cream, and manufactured therefrom 96,981 pounds of butter, for which we received $38,535.82 and paid patrons $32,716.96, at an average price for butter fat for the year of 42.3 cents per pound.

I enclose a summary report of cream received, butter manufactured, money received and paid out since commencing operations in August, 1917.

Lbs. Cream	1,135,743
Lbs. Butter	364 878
Value Butter	$179,794.67
Paid Farmers	$159,179.48

All of which I humbly submit.

A. MacLachlan,
Manager.

Seed Grain, Section 2 (1).

The practice of providing seed grain for settlers in North and North-western Ontario was continued in the spring of 1921. Acting in co-operation with the District Agricultural Representatives, distributing stations were established in the Districts of Rainy River (Emo), Thunder Bay (Port Arthur), Temiskaming (New Liskeard and Matheson), Sudbury (Sudbury), Kenora (Dryden), Manitoulin Island (Gore Bay), Muskoka, Parry Sound and Nipissing (Huntsville). The following quantities of seed were distributed: Oats, 4,568 bushels; wheat, 378 bushels; barley, 428 bushels; clover, 5,870 pounds; alsike, 1,870

pounds; timothy, 8,831 pounds. This seed was supplied, in accordance with the provisions of the Northern and North-western Ontario Development Act 1915, to registered locatees or patentees. Those who did not pay cash at the time of purchase executed a promissory note for the amount of the purchase, with interest at 6 per cent., payable on 1st December, 1921, the note being registered as a first charge against the property. The seed was purchased locally wherever the local Agricultural Representative could obtain the requisite quantity, of good quality and at an approved price.

Cattle Purchase, Section 2 (2).

The settlers in the northern part of the District of Temiskaming, in the neighbourhood of the Provincial Demonstration Farm at Monteith, expressed to the Superintendent there a desire to purchase a good class of cow, and asked the assistance of the Government in obtaining cattle of the best type. The Northern Development Branch purchased through the Farm Superintendent one car load of cows, containing 18 head, obtained in the Powassan section, and these were shipped to Monteith. The farmers in the district readily availed themselves of the opportunity of procuring cows of good quality, and the whole consignment was sold for cash at prices varying from $30 to $60, the total receipts being sufficient to cover the cost of the transaction. The cattle have proved eminently satisfactory.

Section 1 (D).

THE ASSISTANCE OF SETTLERS.

Re Feed Shortage.

The attention of the Department of Agriculture was drawn during the summer of 1921, by the Representative at Gore Bay, to the devastation caused upon Manitoulin Island by the unusual conditions of drought which had prevailed throughout the spring and growing season. As a result, the fodder and grain crops, which have been a source of pride to the farmers of the island in previous years, were extremely small. The condition was intensified through a plague of grasshoppers, which completed the destruction of whatever growth had survived the absence of moisture. The local farmers are noted as large producers of cattle, sheep and hogs, and fears were entertained that unless Government assistance was forthcoming, not only would there be no surplus of feed for wintering the stock, but that the available fodder would not be sufficient to meet their needs during the fall of 1921.

It was decided to assist the agricultural industry on the island by supplying a quantity of hay, oats and corn to the farmers, to be paid for either in cash or by promissory note, executed by the purchaser and a guarantor. Arrangements were made for this distribution to be done through the Northern Development Branch under Section 1 (D) of the Northern and North-western Ontario Development Act, 1912, and amendments.

The quantities estimated to be required were: about 1,500 tons of hay, 27,000 bushels of oats, and 10,000 bushels of corn. The prices which farmers were willing to pay were not to exceed $30 per ton for the hay, 75 cents per bushel for the oats, and $40 per ton for corn. The hay was purchased in the Bar River District, delivered by rail to Little Current; at Sault Ste. Marie, delivered by scow to Gore Bay; at Lion's Head, delivered by boat to Providence Bay; at Owen Sound, delivered by barge to Kagawong, and West Bay; and from various points in the counties of Grey, Bruce and Huron, delivered to Owen Sound, and thence transhipped in part by the Dominion Transportation Company boats to Little Current, Gore Bay and Meldrum Bay; and as to the larger proportion, special arrangements were made for collection and storage on the dock at Owen Sound, and trans-shipment by tug and barges to various docks on the island. The corn and oats were purchased at the elevators at Tiffin and Midland; and this grain was shipped by the specially chartered tug and barges used to transport the hay from Owen Sound.

Considerable difficulties were experienced in the transporting of the feed to the Island. The necessity for importing such large quantities of fodder was unprecedented, and the ordinary means of transportation were inadequate; farmers from whom the hay was purchased were not anxious to dispose of their stocks, owing to the general failure of crops throughout Ontario, and higher prices were anticipated; bad weather during the shipping period interfered with the arrangements made, and postponed delivery until the passage of heavily laden barges across the Georgian Bay became hazardous and slow. The whole of the shipping operations were, however, successfully concluded by the second week in November. Agents were appointed at the various receiving docks, and the feed was immediately available for distribution to the farmers.

The total quantities purchased were 1470 tons hay; 27,000 bushels No. 2 C W. inspected Oats; 13,571 bushels No, 2 Yellow inspected corn.

The prices charged to the farmers were: Hay, $29.00 per ton; corn, $1.77 per bushel, or $36.00 per ton; oats, 74 cents per bushel.

A feed shortage also became evident in the Mattawa District, towards the end of the summer, and four carloads of hay, containing 43 tons, have been shipped there, to partially meet the needs of the farmers in that locality. This hay is being sold at the rate of $27.00 per ton, under the same conditions as feed was supplied to Manitoulin Island.

The feed thus supplied to farmers in affected areas, has been of the greatest benefit in enabling them to avoid disposing of their stock at greatly reduced prices, and it is hoped that, with an average production in the season to come, they will be re-established upon a normal basis.

SUMMARY OF EXPENDITURE.

For the Ten Years Ending 31st October, 1921.
Northern and North-western Ontario Development Fund.

Section.	Summary of Expenditure 23rd May, 1912, to 31st Oct., 1920.	Expenditure for year ending 31st October, 1921.	Total Expenditure to 31st October, 1921.
Section 1 (a) Works and Improvements	$ 2,100.00		$ 2,100.00
Section 1 (b) Roads	6,963,451.00	$1,406,125.78	8,369,576.78
Section 1 (d) Farms	74,757.67	5,210.70	79,968.37
Section 1 (d) Assistance of Settlers		60,056.87	60,056.87
Section 1 (e) Creamery and Grain Elevators	38,374.54	7,470.13	45,844.67
Section 2 (1) Seed Grain	177,972.12	12,640.51	190,612.63
Section 2 (2) Cattle Purchase Account	19,126.06	968.55	20,094.61
Section 2 (6) Fire Protection	3,773.45		3,773.45
Returned Soldiers' and Sailors' Settlement Act, 1917	1,173,638.51	4,274.65	1,177,913.16
	$8,453,193.35	$1,496,747.19	$9,949,940.54
Settlers' Loan Acct., Clause 9 (Amend. Act 1916).	549,401.63	115,775.18	665,176.81
	$9,002,594.98	$1,612,522.37	$10,615,117.35

STATEMENT OF EXPENDITURE.

Under Northern and North-Western Ontario Development Acts, 1912 and 1915.
For the Year Ending 31st October, 1921.

Districts and Sections.		Expenditure, year ending 31st Oct., 1921.
1. Kenora		$ 55,381.42
2. Dryden		67,086.55
3. Port Arthur		60,019,59
4. Fort William		72,334.65
5. Rainy River		126,724.95
6. St. Joseph Island		8,363.78
7. Sault Ste. Marie		136,520.84
8. Sudbury		70,967.72
9. Nipissing		68,996.76
10. Parry Sound		72,159.13
11. Muskoka		76,476.25
12. Renfrew		18,421.12
13. Simcoe		722.51
14. Algonquin Park		6,867.89
15. Manitoulin Island		62,280.93
16. Sundry Surveys (Muskoka, Parry Sound and Nipissing)		6,170.74
17. Temiskaming		475,064.86
18. General Administration		21,566.09
		$1,406,125.78
19. Farms		5,210.70
20. Assistance of Settlers		60,056.87
21. Creamery		7,470.13
22. Seed Grain		12,640.51
23. Cattle Purchase		968.55
24. Returned Soldiers' and Sailors' Settlement Act:		
General Account	$3,923.35	
Adjustment Account	351.30	
		4,274.65
25. Settlers' Loan Account		115,775.18
Total		$1,612,522.37

November 15, 1921.

Arthur E. D. Bruce,
Secretary and Accountant.

STATEMENT OF EXPENDITURE, YEAR ENDING 31ST OCTOBER, 1921.

Making of Roads, Section 1 (b):			
Bruce, A. E. D., Secretary and Accountant, salary	$3,450.00		
Sinton, Jas., Road Engineer, salary	2,400.00		
Beardall, F. G., Principal Clerk, salary	2,100.00		
Lawer, W. L., Senior Account Clerk, salary	1,900.00		
Reid, A., Map Draughtsman, salary	1,700.00		
Dicker, C. L., Clerk, salary	1,400.00		
Fleming, Miss E., Junior Clerk, salary	1,100.00		
Carefoot, Miss O., Clerk-Stenographer, salary	1,050.00		
		15,100.00	
Wages	$793,774.80		
Contracts	253,675.68		
Supplies and Equipment	343,575.30		
		1,391,025.78	
		$1,406,125.78	
Advancement of Settlement and Colonization, Section 1 (d):			
Wages	$4,275.08		
Supplies, Stock and Equipment	935.62		
		5,210.70	
Assistance of Settlers, Section 1 (d):			
Hay, Oats, Corn, Freight and Disbursements		60,056.87	
Creamery, New Liskeard, Section 1 (e):			
Wages	$3,790.17		
Supplies, Equipment, Freight and Expenses	3,679.96		
		7,470.13	
Seed Grain, Section 2 (1):			
Wages	41.25		
Seed, Freight and Disbursements	12,599.26		
		12,640.51	
Cattle Purchase Account, Section 2 (2):			
Cost of Cattle, Freight and Disbursements		968.55	
Returned Soldiers' and Sailors' Land Settlement Act., 1917:			
Wages	$2,786.15		
Supplies and Disbursements	1 137.20		
	3,923.35		
Adjustment Account	351.30		
		4,274.65	
			$1,496,747.19
Settler's Loan Account, Amending Act, 1916:			
Dane, F., Commissioner, salary	$5,000.00		
Kennedy, W. K. P., Accountant, salary	2,500.00		
Crawford G., Stenographer, salary	975.00		
		$8,475.00	
Net amount of loans issued	$105,859.00		
Expenses	1,441.18		
		107,300.18	
			115,775.18
			$1,612.522.37

November 15, 1921.

ARTHUR E. D. BRUCE,
Secretary and Accountant.

NORTHERN DEVELOPMENT BRANCH.

Statement of Revenue for the Year Ended 31st October, 1921.

Section 1 (b) Roads:	
Sale of supplies, stock and equipment, rentals and refunds	$ 2,016.86
Section 1 (d) Farms:	
Sale of produce	2,417.25
Section 1 (d) Assistance of Settlers:	
Cash sales of feed	6,480.82
Section 1 (e) Creamery:	
Butter revenue, sale of buttermilk and cans	6,247.56
Section 2 (1) Seed Grain:	
Notes retired and cash sales	21,796.09
Section 2 (2) Purchase of Cattle Account:	
Notes retired and cash sales	5,943.20
Clause 5 (1-12) Soldiers' Settlement Account:	
Sale of buildings, equipment, stock and material, rentals Kapuskasing and Shackleton Colonies	8,590.91
	$53,492.69
Settlers' Loan Account:	
Payments on Principal, Interest, etc	85,832.63
Total Revenue under all heads, 1921 account	$139,325.32

RECORD OF CORRESPONDENCE.

For Year Ended 31st October, 1921.

Letters received		8,753
Letters mailed	10,712	
Circulars mailed	652	
		11,364

November 15, 1921.

Arthur E. D. Bruce,
Secretary and Accountant.

Appendix No. 47.

46 Richmond St. West,
Toronto, January 14, 1922.

To the Honourable, the Minister of Lands and Forests, Ontario.

Sir,—I have the honour to submit a report of the business of this department to the end of October, 1921, as follows:

Total number of applications received for loans, 2,931, applying for $1,162,864, an average of $396.75 per application, each case being considered on its own merits, and loans advanced on the basis of improvements to land.

The total number of loans granted to settlers was 1,903, amounting to $626,995.00, an average of $329.48. This includes an advance to the Sudbury Co-Operative Creamery Co., Limited, $12,000.00, and a loan of $10,000.00 to Kenora Dairy Co-Operative Association.

The repayments on account of loans has continued to be very satisfactory, 90 per cent. of the payments on account of interest having been made, and 96 per cent. of amount due on account of principal. Some loans have been paid in advance. It is just a question if this good showing will continue, as a number of conditions are not just so favourable as in the past years, but there is a sincere effort on the part of the settlers to live up to the terms on which the loans were advanced.

Recently there have been a large number of applications received—no doubt, due to the fact that settlers are forced to devote more time on their own lots. Lack of other employment that formerly engaged their attention, and that furnished quicker cash returns, is the reason.

Beg to direct your attention to the attached memorandum, giving details of operations carried on, and it's a pleasure to be able to report that settlers continue to express their appreciation for the loans received through this department, acknowledging the help it has been to them in many ways, particularly by enabling them to clear up land.

(Sgd.) F. Dane,
Settlers' Loan Commissioner.

Memorandum of Settlers' Loans to October 31st, 1921.

Applications.

Total number of applications received	2,931
Total amount applied for	$1,162,864.00
Average per application	$396.75
Amount applied for under approved applications	$785,730.00

Loans.

Number of loans issued	1,903
Equal to 65% of applications.	
Amount granted	$626,995.00
Equal to 54 % of total amount applied for and Equal to 80% of total amount applied for under approved applications.	
Average loan	$329.48
Total acreage covered by liens	292,732
Acreage improved land	40,045
Equal to 13.7% of total acreage.	
Average loan per acre on total acreage	$2.14
Average loan per acre on acreage improved land	$15.66

Note.—Figures, except averages include application for, and loan of $12,000.00 to Sudbury Co-operative Creamery Co., Ltd., and $10,000.00 to Kenora Dairy Co-operative Association.

Repayments.

Accrued interest due	$ 95,079.46
Accrued interest received	86,338.37 or 90.80%
Payment on principal due	198,356.17
Payments on principal received	191,235.84 or 96.41%
Total payments due	293,435.63
Total payments received	277,574.21 or 94.59%

Details of Loans Issued and Outstanding.

District.	No. of Loans.	Amount.	Unpaid Principal and Accrued Interest.
Algoma	38	$ 12,105.00	$ 10,262.08
Kenora	198	72,645.00	59,472 80
Nipissing	83	30,300 00	22,874 36
Rainy River	155	49,700 00	32,888 99
Sudbury	71	37,800 00	31,525 23
Temiskaming	816	249,240 00	159,695 02
Thunder Bay	542	175,205 00	127,781 77
Totals	1,903	$626,995 00	$444,500 25

Appendix No. 48.

Report of Forestry Branch, 1921.

Sir,—The report of the work of this Branch for the year ending 31st October, 1921, is given under the sections of Forest Protection, Forest Investigation, Reforestation, and Forest Pathology.

I. Forest Protection.

(1) *Legislation.*

No changes have been made in the Forest Fires Prevention Act since 1918. The experiences of the past two seasons have indicated, however, that amendments making fire-fighting compulsory and providing for jail sentences as well as fines for certain infringements of the Act, are desirable. This latter applies especially to the Permit Regulations.

(2) *Organization and Personnel.*

The supervision of the field force was carried on by one Forest Supervisor, with headquarters at Kenora, and three Fire Inspectors, with headquarters at Cochrane, Sudbury, and Parry Sound.

A re-arrangement of Chief Ranger Districts was made, and two more Chief Rangers added to the staff, making a total of thirty-two, with fifty Deputy Chief Rangers. This allowed direct field supervision on the basis of one deputy or chief ranger to every thirteen rangers.

The average daily force was as follows: April, 22; May, 591; June, 1014; July, 1,035; August, 1,027; September, 467; October, 33. The total number

of persons employed for at least a part of the season, was 1,228. Of these 142 resigned, and 69 were dismissed.

Owing to the fire season being early, over half the staff (568) were on duty by the middle of May, and by the end of the month the number had risen to 962. On the fifteenth of June, the total number on the pay roll was 1,014; on the first of July, 1,022; on the fifteenth of July, 1,036; on the first of August, 1,029, and on the fifteenth of August, 1,034. By the end of August, however, it was possible to discontinue several patrols, so that the total number of men on duty was reduced from 1,034 to 977 between the middle and the end of August. On the fifteenth of September, there were only 533 men on duty, and by the end of the month this number had been reduced to 78, practically all of those left being engaged in repairing equipment and finishing up certain local improvements.

As stated in previous reports, one of the chief factors mitigating against a successful controlling of forest fires in Ontario, is the impermanency of the personnel. Fire-ranging is a specialized line of work, requiring special training, and until a permanent organization of trained men is built up, progress will be slow.

(3) *Expenditure.*

The expenditure for the fiscal year was $610,534.74, classified as below, with the figures for the preceding years given for comparison. Against this expenditure, protection accounts for the year totalled approximately $181,047.32.

CLASSIFICATION OF EXPENDITURE.

Item.	1921	1920	1919	1918
Pay roll	$433,463.02	$398,919.61	$405,212.30	$416,500.00*
Equipment	28,384.40	22,287.83	22,899.02	28,350.00
Expendable property	19,505.86	16,589.99	13,903.06	10,700.00
Travel (inspection)	21,034.95	17,495.93	15,826.37	13,440.00
Improvement work	3,621.06	1,591.01	4,765.35	4,280.00
Extra fire fighting	65,267.79	41,491.24	58,863.92	1,445.00
Express, postage, etc.	7,926.65	5,401.02	5,646.47	5,365.00
Miscellany	31,331.01	2,331.08	5,955.02	6,054.78
Total	$610,534.74	$506,107.71	$528,071.51	$486,134.78

* Figures rounded off.

(4) *Fires.*

There was very little snow in the winter of 1920-21 and this disappeared very early in the spring. Then followed very unusual weather conditions, practically no rain falling in some districts until August, and in others not until September. Because of this early hazard it was necessary to place the full ranging staff on duty as fast as possible.

CLASSIFICATION OF FOREST FIRES.

By Month.

Month.	1921	1920	1919	1918	1917
	No.	No.	No.	No.	No.
April and May	301	422	362	294	449
June	290	309	414	273	320
July	475	142	613	124	158
August	97	300	377	268	117
September and October	106	114	14	6	66
Totals	1,269	1,287	1,780	965	1,110

By Origin.

Origin.	1921		1920	1919	1918	1917
	No.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Settlers	122	9.6	11.0	7.7	8.1	8.2
Campers	112	8.8	11.7	9.2	9.7	13.9
Railways	188	14.8	23.9	37.0	46.5	49.5
Lightning	139	11.0	1.1	3.0	3.8	2.9
Logging operations	64	5.0	4.6	2.5	4.1	4.1
Miscellaneous	14	1.1	7.2	4.3	4.6	3.6
Unknown	630	49.7	40.5	36.3	23.2	17.8
	1,269	100.0	100.0	100.0	100.0	100.0

By Size.

Size.	1921		1920	1919	1918	1917
	No.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Quarter acre and under	264	20.8	23.2	30.5	40.5	36.3
Over quarter to 5 acres	304	24.0	29.4	27.7	33.7	19.5
Over 5 to 10 acres	86	6.8	8.1	6.1	6.0	4.8
Over 10 to 100 acres	259	20.4	17.1	16.5	13.6	9.5
Over 100 to 500 acres	169	13.3	12.0	8.7	5.1	4.7
Over 500 acres					1.1	25.2
Over 500 to 1,000 acres	70	5.5	5.0	3.3		
Over 1,000 to 10,000 acres	103	8.1	4.9	5.9		
Over 10,000	14	1.1	0.3	1.3		
	1,269	100.0	100.0	100.0	100.0	100.0

Of the total number of fires, settlers were responsible for 122, or 9.6 per cent. A large part of these (45) were permit fires which for various reasons were allowed to get beyond control. Included in this 122 were also 11 fires set without permits, and in connection with which court proceedings were instituted. Convictions were secured in ten instances, the penalties ranging all the way from a fine of ten dollars and costs to one hundred dollars and costs, and in one case a sentence of thirty days' hard labor was imposed.

The number of fires known to be caused by campers was 112, or 8.8 per cent of the total.

The number of fires directly attributed to railways, with a total of 4,951 miles within the Fire Districts of the Province, was 188, or 14.8 per cent. of the total number from all causes, a decrease in the percentage of 9.1 per cent. over 1920, and 34.7 per cent. over 1917. This decrease is due largely to the increased attention given to locomotive inspection by our staff.

The fires of railway origin were distributed as follows:

Railway.	Per cent. of Total Number of Railway Fires.			
	1921	1920	1919	1918
Canadian National Railway (exclusive of Northern line)	44.7	32.3	24.6	25.4
Canadian Pacific Railway	29.8	27.9	26.3	24.9
Canadian National Railway (Northern Transcontinental line only)	7.9	16.4	25.9	21.8
Temiskaming and Northern Ontario Railway	10.6	9.9	17.9	10.5
Algoma Eastern Railway	2.8	5.0	0.3	2.9
Algoma Central Railway	1.0	4.4	1.5	1.1
Grand Trunk Railway	3.2	4.1	3.5	13.4
	100.0	100.0	100.0	100.0

Average Number of Railway Fires Per Hundred Miles of Line.

Canadian National Railway (exclusive of Northern line)	5.8
Canadian Pacific Railway	3.9
Canadian National Railway (Northern Transcontinental line only)	1.8
Temiskaming and Northern Ontario Railway	6.3
Algoma Eastern Railway	5.9
Algoma Central Railway	0.6
Grand Trunk Railway	1.6

Lightning is credited with starting 139 fires, or 11.0 per cent. of the total number of all fires, a decided increase over previous years, due no doubt to the occurrence of many electrical storms, which were accompanied by little or no precipitation, and fires which ordinarily would have been extinguished by the rain without making themselves apparent, were able this year to gain considerable headway. Fires from this source were restricted largely to a few regions, especially the Algonquin Park district, where 47 of the 139 lightning fires occurred.

A total of 749,534 acres were reported burned over, more than twice the area burned over in 1920, due largely to the exceptional weather conditions prevailing throughout the season. This acreage was classified as below:

CLASSIFICATION OF BURNED-OVER AREA.

Forest Condition.	1921		1920	1919	1918	1917
	Acres	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Timber land	99,104	13.2	14.7	26.8	15.8	19.1
Cut-over land (some timber left)	190,977	25.5	38.8	27.3	37.0	39.2
Young growth (below six inches)	151,700	20.2	26.7	25.3	23.5	19.5
Barren and grass land	307,753	41.1	19.8	20.6	23.7	22.2
	749,534	100.0	100.0	100.0	100.0	100.0

As the table shows, the area of timber land burned over this season was 13.2 per cent. of the total area burned, slightly lower than the figure for last year, and considerably lower than the figure for 1919.

Land which had been cut over, but upon which there was some timber left, and land upon which young growth existed, formed 25.5 and 20.2 per cent. respectively of the area burned. It is upon these two classes of land that we must depend to a large extent for our future timber crop, and the importance of protection on these areas can not be too strongly emphasized. Until a systematic system of brush disposal is inaugurated in connection with logging operations, little can be accomplished in the protection of these cut-over areas.

The high percentage of barren and grass land burned over is due to the large areas of swamps and muskegs burned, the season being so dry that these swamps and muskegs became quite inflammable, a rather unusual occurrence.

On the shore of Lake Nipissing, Parry Sound District

CLASSIFICATION OF FOREST AREAS BURNED OVER, 1921.

Ranger District.	Number of fires	Timber land, mainly coniferous, i.e., soft-wood	Timber land, mainly hardwood	Cut-over land, some softwood left	Cut-over land, some hardwood left	Young growth, mainly coniferous	Young growth, mainly hardwood	Barren land	Grass land	Totals (acres)
I. Western Inspectorate—										
1. Kenora District	42	4,563	5	1,117	225	2,422	19	9,226	10	17,587
2. Rainy River	62	3,408	3	2,880	635	513	234	408	1	8,082
3. Thunder Bay	48	23	3	130	.....	23	42	1,415	134	1,770
4. Nipigon	12	8	.....	.....	.....	3	.....	13	5	29
5. C. G. R.—Western	10	.....	.....	.....	.....	.....	.....	649	8	657
6. C. G. R.—Central	11	.....	.....	.....	.....	.....	.....	25,640	.....	25,640
	185	8,002	11	4,127	860	2,961	295	37,351	158	53,765
II. Northern Inspectorate—										
1. Hearst	12	3	.....	810	.....	29	.....	27	.....	869
2. Kapuskasing	13	12	.....	540	570	45	.....	140	.....	1,307
3. Cochrane	75	1,073	46	8,671	612	2,110	.....	4,532	82	17,126
4. Abitibi	17	7,790	.....	15,850	3,800	2,600	.....	24,715	.....	54,755
5. Timmins	49	3,018	.....	12,601	1,020	250	.....	9,215	31	26,135
6. Matheson	32	6,890	200	360	5,512	2,675	235	16,067	45	31,984
7. New Liskeard	14	75	.....	1,300	85	135	.....	255	5	1,855
	212	18,861	246	40,132	11,599	7,844	235	54,951	163	134,031
III. Central Inspectorate—										
1. Soo	28	3,434	.....	400	3,908	.....	3,651	21,877	5	33,275
2. Webbwood	76	1,052	2,002	2,555	3,121	75	1,225	24,823	53	34,906
3. Sudbury	64	1,354	169	560	3,733	4,761	7,433	8,488	17	26,515
4. North Bay	57	6,634	220	1,491	2,832	7,801	65,762	6,191	376	91,307
5. Mississagi	11	440	.....	640	.....	203	456	124	.....	1,863
6. Chapleau	43	405	.....	1,291	109	366	974	13,275	527	16,947
7. Longlac	7	171	.....	50	.....	80	.....	101	.....	402
8. Foleyet	79	11,252	.....	5,560	3	8,106	.....	2,526	5	27,452
9. Timagami, W. & S.	18	21,180	3	872	.....	900	100	280	.....	23,335
10. Timagami, East	62	2,262	101	1,065	837	214	323	502	2	5,306
11. Timagami, North	25	8,404	.....	2,081	1	4,800	.....	11,747	.....	27,033
12. Algoma Central	46	6,018	11	28,465	10,782	2,179	806	11,648	320	60,229
	516	62,606	2,506	45,030	25,326	29,485	80,730	101,582	1,305	348,570

VI. Southern Inspectorate										
1. Parry Sound	63	4,957	12	1,010	28,917	10,586	6,288	52,015	...	103,785
2. Muskoka	28	15	160	5	315	5	360	2,607	3	3,470
3. Algonquin, North	61	8	.....	13,512	9,240	4,865	3,776	27,115	100	58,616
4. Algonquin, South	79	23	1	2,440	2,367	282	1,712	21,630	1	28,456
5. Madawaska	36	460	100	1,625	1,345	146	849	1,337	185	6,047
6. Trent	79	850	286	627	2,500	292	694	7,179	69	12,497
7. Eastern Reserve	10	.....	.....	.....	.....	103	192	2		297
	356	6,313	559	19,219	44,684	16,279	13,871	111,885	358	213,168
Totals	1,269	95,782	3,322	108,508	82,469	56,569	95,131	305,769	1,984	749,534
Per Cent	.....	12.8	0.4	14.5	11.0	7.5	12.7	40.8	0.3	100.0
1920 Totals	1,287	38,539	14,319	116,312	23,126	46,595	49,135	70,093	732	358,851
1919 Totals	1,780	223,022	24,244	102,884	148,471	109,752	123,444	189,701	643	922,161
1918 Totals	965	3,123	1,634	5,661	5,513	1,797	5,303	6,465	676	30,172
1917 Totals	1,110	73,160	135	148,408	2,160	61,806	13,202	82,959	2,334	384,164

(5) *Permits.*

Permits were issued in 139 townships, as compared with 123 townships in 1920 and 136 townships in 1919. A total of 5,966 permits were issued, covering an area of 23,678 acres, 158 permits less than were issued in 1920.

As shown in the tables below, the greatest number of permits were issued in the districts of Matheson, Cochrane, and Hearst. Most of the burning under permit was done during the month of June, 3,085 permits being granted, with 1,329 in September and 1,154 in May. During the month of July, it was necessary, in some districts, to prohibit burning, owing to the exceptionally dry weather.

STATEMENT OF PERMITS ISSUED.

Ranger District.	Number of Permits.				
	1921	1920	1919	1918	1917
Cochrane	1,503	1,982	2,275	3,493	.....
Matheson	1,599	1,887	1,691	2,346	.....
New Liskeard	916	1,169	1,557	2,179	.....
Hearst	1,082	756	702	514	.....
Timmins	407	193	199	651	.....
All other districts	459	167	211	407	.....
Totals	5,966	6,154	6,635	9,590	3,486

	Number of Permits.				
	1921	1920	1919	1918	1917
May	1,154	1,003	1,536	2,248	.....
June	3,085	2,011	2,786	2,899	.....
July	364	891	496	2,050	.....
August	1,329	1,620	1,475	2,156	.....
September	34	629	342	237	.....
Totals	5,966	6,154	6,635	9,590	3,486

Ranger District.	Acreage Burned Over Under Permit.				
	1921	1920	1919	1918	1917
Cochrane	4,652	4,984	5,437	10,267	.....
Matheson	5,442	5,427	4,760	7,371	.....
New Liskeard	7,726	9,768	13,521	17,863	.....
Hearst	2,124	1,478	1,379	1,134	.....
Timmins	988	424	925	1,971	.....
All other districts	2,746	686	768	1,072	.....
Totals	23,678	22,767	26,790	39,683	15,186

(6) *Equipment.*

The most important addition to our equipment this season was ten portable fire-fighting pumps. These pumps are supplied with from 500 to 1,000 feet of hose, and have proved of inestimable value in fire-fighting. There were also purchased 168 pairs of blankets, 29 canoes, 51 tents, 12 railway velocipedes, 2 railway motor cars, and 2 power boats, one 18 feet and the other 27 feet in length.

(7) *Railway Inspection under B.R.C.*

No change was made in the organization of the inspection of fire protective appliances on railway locomotives, two inspectors devoting their whole time to this work.

LOCOMOTIVE INSPECTION, 1921.

Railway	Number Inspected. Times. 1	2	3	4	5 & over	Total Number Engines 1921	Total Number Inspections. 1921	1920	1919	1918	1917	Inspections showing defects 1921	Percentage Defective. 1921	1920	1919	1918	1917
C.P.R...	121	73	47	48	23	312	723	660	499	448	328	60	8.3	16.8	29.9	36.4	19.5
C.N.R. .	65	46	23	27	29	190	498	351	317	232	154	48	9.7	7.9	15.5	22.4	39.6
G.T.R...	86	34	21	5	1	147	242	226	155	184	60	4	1.7	4.8	11.0	28.3	20.0
A.C. & H.B.R. .	4	7	4	..	1	16	35	25	23	36	37	8	22.8	12.0	13.0	38.8	45.9
A.E.R...	...	1	1	3	2	7	28	26	18	20	36	6	21.4	46.1	16.7	70.0	55.5
	276	161	96	83	56	672	1,526	1,288	1,012	920	615	126	8.3	12.8	21.8	32.1	28.3

A total of 41 round-houses was visited, and 1,526 locomotive inspections made, covering 672 locomotives, as against 1,288 inspections in 1920 on 659 locomotives. The above table shows that not only has the number of inspections increased each year, but the percentage of locomotives found defective has steadily decreased from 32.1 per cent. in 1918 to 8.3 per cent. in 1921; and in keeping with this, the percentage of fires definitely attributed to railways has decreased from 46.5 per cent. in 1918 to 14.8 per cent. this year.

The average cost per inspection in 1921 was $1.70, as compared with $1.86 in 1920, and $2.07 in 1919.

II. Forest Investigation.

Ottawa-Huron Survey.—This season the work of forest reconnaissance of the Province was continued, and the country within the fire district south of the French and Ottawa Rivers completed, the settled parts of Parry Sound and Muskoka excepted.

For the purposes of comparison, the surveyed area is divided into seven districts, namely, Algonquin Park, Ottawa Valley, Renfrew, Madawaska, Muskoka, Parry Sound, and Georgian Bay. Of these, Madawaska was, in part, covered the previous summer (1920) by three forestry graduates, and the results of both surveys are included in the figures of this report. It may be explained that the boundaries of these districts do not correspond with the existing municipal boundaries, except in the case of Algonquin Park. Ottawa Valley is taken as the fringe of country between the Park and Ottawa River. Renfrew includes those portions of Nipissing and Renfrew counties south-east of the Park. Madawaska takes in northern and eastern Hastings and the northerly portions of Frontenac and Lennox and Addington. Muskoka refers only to a small north-eastern part of that district. Georgian Bay is applied to the western portion of Parry Sound and Muskoka districts. Parry Sound covers the remainder of Parry Sound district, except the central north and south alienated strip. Trent refers to northern Peterborough and central and western Hastings.

In order to fully understand this report, a few remarks on the subject of ownership conditions will be necessary.

Ownership.—Of the total area, about 65 to 70 per cent. remains in the Crown. In the Algonquin Inspectorate (Algonquin Park, Ottawa Valley, Renfrew), this represents approximately 90 per cent. of the total area. Here, the patented lands exist as a fringe of varying width along the Ottawa River front, and as more or less solid masses with intervening and scattered Crown lands, in Renfrew. In the Georgian Bay Inspectorate (Georgian Bay, Parry Sound, Muskoka), Crown lands comprise 60 per cent. of the total area. The bulk of these are located in a solid block in the north-east sector and on the shores of Georgian Bay; the remainder are found in the south-east sector, along the eastern border of the Inspectorate and adjacent to Algonquin Park. In the Trent Inspectorate (Madawaska and Trent), the distribution of Crown and patented lands is quite different. Instead of being located in separate localities, the Crown lands are interspersed throughout the area in blocks of up to 30 or 40 square miles, surrounded and cut off by the holdings of settlers. Thus we have many smaller forests, more or less set off by themselves, with agricultural land in between.

Land under license comprises 9,587 square miles, of which the Algonquin Inspectorate forms 55.6 per cent., Parry Sound 26.1 per cent., and Trent Inspectorate 18.3 per cent. This relation bears a striking resemblance to the timbered areas yet containing commercial supplies within the Inspectorates, as out of a total of 1,507,539 acres, Algonquin forms 58.5 per cent., Parry Sound 24.7 per cent., and Trent 16.6 per cent.

The diversity of ownership conditions within the Inspectorate, indicating, as they do, the relative occurrence of timber or young growth, will undoubtedly call for different forms of forest management.

In the survey proper, the following will, in brief, describe the classification used, the methods employed, and some of the results obtained. Further information, regarding composition of parties, routes, cost of survey, dates, etc., is given in the appendix.

Field Work. Forest type maps were prepared in the field, delimiting cleared land from barrens and forest. The forest area was differentiated into hardwood, coniferous and mixed types, with the poplar-birch type separated from the other hardwoods. The first three types were classified as to condi-

tion, namely, virgin, moderately culled, severely culled, second growth, and young growth. The poplar-birch stands were thrown into two groups, on the basis of whether white pine reproduction was in evidence or not. The mixed type was defined as containing more than 20 per cent. numerically of either hardwood or conifers among the dominants. Young growth corresponds to saplings up to 4 inches; second growth to polewood above 4 inches.

On these maps, showing forest types and conditions, there were also placed roads, trails, abandoned roads, railway lines, existing telephone lines, watershed boundaries, and good locations marked for lookout points for fire ranging use. Along with this field mapping, information was compiled by townships, covering such points as present fire hazards, location and number of male help available for fire fighting, wood-using industries and mills in existence, nature and extent of other industries such as farming, mining, game and fish, tourist traffic, population, general suitability of the area for agriculture, etc.

From Calabogie, two parties commenced work on the settled sector southeast of Algonquin Park (Renfrew). With this completed, a third party was formed, and all three followed respective railway lines—C.P.R., C.N.R., G.T.R. — thence along the Ottawa River and through the Park. On the completion of the Algonquin Park area, one party struck across-country from Trout Creek to C.N.R., and south, so covering the Parry Sound sector. The other two parties attacked the Georgian Bay sector, one party following the C.P.R. north from Parry Sound, and the other travelling south by launch and canoe.

Effective use of Ford cars in the more settled sections of Ottawa Valley, Parry Sound, Renfrew, Madawaska, and of canoes in Algonquin Park and Georgian Bay sectors, combined to speed up the work and minimize waste of power and energy.

Sixteen forestry students were employed in the summer's work, working under the immediate direction of Messrs. G. M. Dallyn, P. McEwen, and W. A. Delahey of this Branch. Two parties of eight and one of three formed separate camps. The method of work was by foot, with distances computed by pacing. Men worked in pairs. Each pair was given a block of territory to cover, involving about twenty miles travelling, daily. This may mean an area from nine to fifteen square miles, depending on the nature of the settlement, i.e., existing roads, etc., and topography. Boundaries of forest types were checked from lookout sites. Railways, junction of roads, surveyed lakes, rivers, lot lines, served as tying in points, and in less settled districts, compass triangulation was employed.

In all, 7,682,518 acres were examined at a cost of one-quarter of a cent per acre.

Forest Composition.—Of 7,213,372 acres of land investigated in 1920 and 1921, 79.2 per cent. is forested, 10.9 per cent. is barren, and 9.9 cleared. Lakes form an additional area of 469,146 acres, or 6.1 per cent. of the total area examined.

First, let us discuss the composition of the forest area. The composition of the forested area (5,710,291 acres) is made up of 36.6 per cent. mixed; 22.4 per cent. poplar-birch: 19.1 per cent. hardwood; 18.2 per cent. poplar-birch-coniferous; and 3.7 per cent. coniferous. The mixed type occupies over one-half of the forested area in each of Algonquin Park, Parry Sound, and Georgian Bay districts, and these contain 73.2 per cent. of the total mixed forest. The

remaining sectors have relatively more cleared land, an older logging history, a consequent longer fire record and therefore, a much smaller proportion of this desirable composition.

Of the forested area, 2,319,334 acres, or 40.6 per cent., represents combinations of poplar and birch, with and without conifers. Of this, 44.8 per cent. contains a noticeable pine admixture. In the unsettled timbered areas of Algonquin Park and Parry Sound, this type represents but one-fifth of the forested land, whereas in the remaining settled sections, it represents one-third.

3.7 per cent., or 206,935 acres, were classified as coniferous forests. Almost one-half of this is, again, located in Algonquin Park.

Hardwoods cover 19.1 per cent., or 1,097,419 acres, of the forest. This type usually represents a culled virgin, mixed stand, the conifers having been largely removed. This condition is particularly noticeable in the Muskoka region, representing here, one-half the forest. In Algonquin Park, Parry Sound and Madawaska, one-fifth, and in the Ottawa, Georgian Bay sectors, one-twentieth of the forest is so classified.

Conditions.—The following outstanding features in the various forest conditions may be of interest. Only 26.4 per cent. of the present total forest area is virgin or moderately culled, that is, one-quarter of the forested area contains commercial timber, represented by 51.5 per cent. mixed, 45.1 per cent. hardwood, and only 3.4 per cent. coniferous composition. Algonquin Park contains three-fifths, Parry Sound one-fifth, of the mixed, while, of the hardwoods, Algonquin Park contains one-half and Madawaska one-quarter.

Areas classed as severely culled form 10.6 per cent. of the forest, and include a diversity of conditions, mainly due to the almost inevitable fire following the logger. This may be represented by alternate patches of young growth and small stands of timber, or by second growth stands with scattered mature trees of indifferent character. This type of forest presents a particularly vicious fire hazard to commercial stands, owing to the accumulated slash following recent logging operations. This condition is particularly true of the Parry Sound district, where one-fifth of the forest was so classified.

Second growth in the mixed-hardwood-coniferous forests covers 18.7 per cent. of the forest area, or 1,066,556 acres. Four-fifths of this is mixed composition—a satisfactory condition of reproduction—36.2 per cent. of which is found in Algonquin Park.

Young growth in the mixed-hardwood-coniferous forest is represented by 210,296 acres, or 3.7 per cent. of the forested area. Of this, 64.8 per cent. is mixed composition, over three-fifths of which is found in the Georgian Bay sector.

Second growth poplar-birch stands occupy 529,555 acres, or 9.3 per cent. of the forested area. 73.0 per cent. of this contains a coniferous admixture—mainly white pine—of which Algonquin Park comprises 41.6, Ottawa Valley 28.9, and Madawaska 21.7 per cent., while Georgian Bay, Parry Sound, and Madawaska districts, together, only represent 1.9 per cent. of this type. There remain 143,317 acres where conifers are not noticeably present. With this type of forest, there is usually present an understudy of balsam or hemlock, and in the more open stands, pine. The future of such forests is, therefore, relatively satisfactory, always providing fire is kept out.

Young growth of poplar-birch type occupies 1,789,779 acres, or 31.3 per cent. (almost one-third), of the total forest. Of this, 36.9 per cent. has coniferous admixture of which Madawaska contains 64.3 per cent. One-fifth of

the total forested area is then in a semi-barren condition, supporting, in the main, poplar-birch degenerates with an occasional fire-scarred pine.

Of the total area, barrens occupy 10.9 per cent., or 790,092 acres, a pitiful representation of the original pinery. This condition is most pronounced in the Madawaska and Georgian Bay sectors.

Cleared land comprises 9.9 per cent., or 712,989 acres. Of this, the settled district south of Algonquin Park, represents 76.9 per cent.; Ottawa Valley and Parry Sound, together, 21.3; while, in Algonquin Park and Georgian Bay, we find only 1.8 per cent. From the nature of the country, the presence of so many abandoned farms, and the general appreciation of most of this sector as a crop-producing area, it is not likely that the present percentage of cleared land will increase.

Summary.—A study of these pages reveals the fact that, as a result of logging operations and repeated fires, over 60 per cent. of the original forest —which was of a mixed or coniferous character—is now occupied by less desirable types, and instead of the former pineries, occupying one-half the area, we find only 3.1 per cent. thus occupied, pine having been superseded by poplar-birch and barrens on the remaining areas.

In summing up, the conditions over the whole area, excluding cleared land, are shown in the following table.

TABLE SHOWING BY PERCENTAGES THE RELATIONSHIP OF CONDITIONS ON THE POTENTIAL FOREST AREA.

Condition.	District.						
	A.	O.	R.	Ma.	M.	P.S.	Totals
Vigin and moderately culled	44.2	5.2	11.3	13.9	65.5	28.7	23.3
Severely culled	6.2	4.4	9.4	10.0	2.9	20.3	9.3
Second growth	35.3	38.4	16.6	19.4	1.4	18.4	24.6
Young growth	8.3	40.6	40.8	46.7	30.2	20.0	30.7
Barrens	6.0	11.4	21.9	10.0	0.0	12.6	12.1

A.—Algonquin Park; R.—Renfrew; Ma.—Madawaska; M.—Muskoka; P.S.—Parry Sound; O.—Ottawa Valley.

In the above table, the potential forest land is classified as follows: Timber, i.e., virgin and moderately culled areas, 23.3 per cent.; cordwood and distillation material or severely culled areas, 9.3 per cent.; second growth, 24.6 per cent.; young growth, 30.7 per cent.; and barrens, 12.1 per cent.

From this we can see the varied character of the relationship of the forest conditions in the various districts, for example, in Algonquin Park, we find 44.2 per cent. timber, 35.3 per cent. second growth, with only 8.3 per cent. young growth; while in the Madawaska, only 13.9 per cent. timber land remains, second growth occupying 19.4 per cent., with young growth representing almost 50 per cent. of the area. It also shows, in the case of Muskoka district, practically no intermediate or second growth.

The outstanding feature of the present condition of these 6,500,000 acres. as a whole, is the undesirable transformation by the agency of fire after logging, The three types—poplar-birch with coniferous reproduction, the poplar-birch without, and the barrens—represent, in general, logged-over areas burned an

increasingly large number of times, and were once largely occupied by pine. In addition, we may assume that the present areas, classed as mixed young and second growth, were formerly largely pine. These several classes now occupy 62.3 per cent. of the potential forest area, where once pine stands predominated.

It is of interest to note the future outlook as regards the next crop of softwood saw timber on this large area of over four million acres. We may fairly assume that a relatively satisfactory reproduction of pine occurs on the area now occupied by immature mixed growth —15.1 per cent. Of the remainder, a partial pine restocking occurs only on the areas typed as poplar-birch-coniferous, or 15.8 per cent. The balance (31.4 per cent.), typed as poplar-birch and barrens and totalling 2,072,719 acres, is without hope of coniferous growth. This condition is most prevalent in the more settled districts, like Madawaska and Renfrew, and in the sparsely settled Georgian Bay sector, through which two railway lines run. The worst sector is that of Renfrew, adjoining the timbered region of Algonquin Park.

The above represents the universal history of forest areas after logging. Until brush disposal accompanies all logging operations, this degeneration of forest growth will go on.

Appended are the detailed tables.

ALGONQUIN, GEORGIAN BAY, TRENT FOREST SURVEY, 1921—CLASSIFICATION OF LANDS.

	Airy		Algona, S.		Algona, N.		Alice		Anglin	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
I. Cleared Land	3,390	7.3	12,865	38.7	9,405	39.6	32,292	56.8		
II. Forest:										
1. Hardwood:										
Virgin and moderately culled	1,050									
Severely culled	4,175		505							
Second growth					194					
Young growth			110							
	5,225	11.4	615	1.9	194	0.8				
2. Coniferous:										
Virgin and moderately culled							140			
Severely culled			705		40				800	
Second growth	625		1,355		100		198		3,040	
Young growth			290		60		284			
	625	1.3	2,350	7.1	200	0.8	622	1.1	3,840	8.0
3. Mixed:										
Virgin and moderately culled									1,740	
Severely culled	820		315		238		1,804			
Second growth			12,530				2,522		38,434	
Young growth							2,536			
	820	1.8	12,845	38.6	238	1.0	6,862	12.1	40,174	83.8
4. Poplar-Birch, 5 to 20 per cent. coniferous reproduction:										
Standards and poles	75		480		250		1,684		2,130	
Saplings			2,030				220		925	
	75	0.1	2,510	7.6	250	1.1	1,904	3.4	3,055	6.4
5. Poplar-Birch, without coniferous reproduction:										
Standards and poles	50				420		10,388		565	
Saplings	1,850		2,045		12,984		4,716		130	
	1,900	4.1	2,045	6.1	13,404	56.7	15,104	26.6	695	1.5
III. Barrens	34,290	74.0							155	0.3
Land area investigated	46,325		33,230		23,691		56,784		47,920	

MUSKOKA, GEORGIAN BAY, TRENT FOREST SURVEY, 1921—CLASSIFICATION OF LANDS.—*Continued.*

	Baxter		Bagot		Ballantyne		Barron		Bethune	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
I. Cleared Land	1,455	4.2	14,485	21.6					2,755	6.0
II. Forest:										
1. Hardwood:										
Virgin and moderately culled	870				5,385				19,205	
Severely culled					6,290				14,410	
Second growth	1,830		160				360			
Young growth							490			
	2,700	7.7	160	0.2	11,675	26.2	850	1.9	33,615	73.6
2. Coniferous:										
Virgin and moderately culled					290					
Severely culled					105					
Second growth							6,540			
Young growth					1,455					
					1,850	4.1	6,540	14.4		
3. Mixed:										
Virgin and moderately culled					17,680					
Severely culled					380				3,460	
Second growth	12,570		27,830		4 980		12,815		2,140	
Young growth					360					
	12,570	36.1	27,830	41.4	23,400	52.6	12,815	28.2	5,600	12.2
4. Poplar-Birch, 5 to 20 per cent. coniferous reproduction:										
Standards and poles	960		7,912				17,260			
Saplings	7,115		11,066						105	
	8,075	23.1	18,978	28.2			17 260	38.2	105	0.2
5. Poplar Birch without coniferous reproduction:										
Standards and poles			5,572		570		2,850			
Saplings	7,835		219		340		4,980		90	
	7,835	22.4	5,791	8.6	910	2.0	7,830	17.3	90	0.2
III. Barrens	2,270	6.5			6,680	15.1			3,575	7.8
Land area investigated	34,905		67,244		44,515		45,295		45,740	

ALGONQUIN, GEORGIAN BAY, TRENT, FOREST SURVEY, 921—CLASSIFICATION OF LANDS. *Continued.*

	Blair		Blythfield		Boulter		Bonfield		Bower	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
I. Cleared Land	40	0.0	1,864	5.6	4,840	10.8	17,540	35.0	140	0.1
II. Forest:										
1. Hardwood:										
Virgin and moderately culled					1,095		710			
Severely culled	4,590				1,390					
Second growth					570		2,160			
Young growth					120		735			
	4,590	7.0			3,175	6.6	3,605	7.2		
2. Coniferous:										
Virgin and moderately culled	5,650								945	
Severely culled										
Second growth	2,820								555	
Young growth					90					
	8,470	12.8			90	0.2			1,500	4.0
3. Mixed:										
Virgin and moderately culled	4,170				1,230		780		16,850	
Severely culled	660		680		1,970					
Second growth	36,420		11,138		4,720		4,355		9,585	
Young growth							1,265			
	41,250	62.6	11,818	35.4	7,920	16.5	6,400	12.7	26,435	69.8
4. Poplar-Birch, 5 to 20 per cent. coniferous reproduction:										
Standards and poles					3,450		1,820			
Saplings	5,365		18,200		830		2,730			
	5,365	8.2	18,200	54.3	4,280	8.9	4,550	9.1		
5. Poplar-Birch, without coniferous reproduction:										
Standards and poles					1,860		1,060			
Saplings	3,640				14,995		14,925			
	3,640	5.5			16,855	35.2	15,985	31.7		
III. Barrens	2,540	3.9	1,556	4.7	10,430	21.8	2,175	4.3	9,930	26.1
Land area investigated	65,895		33,438		47,590		50,255		38,005	

ALGONQUIN, GEORGIAN BAY, TRENT, FOREST SURVEY, 1921—CLASSIFICATION OF LANDS. *Continued.*

	Boyd		Bishop		Burpee		Brown		Burton	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
I. Cleared Land			80	0.2	430	1.1				
II. Forest:										
1. Hardwood:										
Virgin and moderately culled	14,180		2,365						1,840	
Severely culled									350	
Second growth	400				105				440	
Young growth										
	14,580	23.0	2,365	6.2	105	0.3			2,630	5.0
2. Coniferous:										
Virgin and moderately culled										
Severely culled										
Second growth	965		960				510			
Young growth										
	965	1.5	960	2.5			510	1.2		
3. Mixed:										
Virgin and moderately culled	1,965		24,805		840		1,895		2,400	
Severely culled			4,995		13,120		3,655		605	
Second growth	4,800		1,570		2,220		6,580		620	
Young growth			1,050		450		960		330	
	6,765	10.6	32,420	85.2	16,630	43.3	13,090	29.8	3,955	7.7
4. Poplar-Birch, 5 to 20 per cent. coniferous reproduction:										
Standards and poles	9,250		180							
Saplings	1,850		130				3,405		2,350	
	11,100	17.5	310	0.8			3,405	7.7	2,350	4.5
5. Poplar-Birch, without coniferous reproduction:										
Standards and poles	2,260									
Saplings	5,845		1,440				12,975		9,320	
	8,105	12.8	1,440	3.8			12,975	29.6	9,320	17.8
III. Barrens	21,985	34.6	500	1.3	21,245	55.3	13,900	31.7	33,880	65.0
Land area investigated	63,500		38,075		38,410		43,880		52,135	

ALGONQUIN, GEORGIAN BAY, TRENT, FOREST SURVEY, 1921—CLASSIFICATION OF LANDS.—*Continued.*

	Bronson		Brougham		Brudenell		Buchanan		Burns	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
I. Cleared Land	.....	.....	9,090	14.2	15 726	30.0	4,800	25.2	148	0.3
II. Forest:										
1. Hardwood:										
Virgin and moderately culled	180	.....	380	.....	528	.....	.....	.....	3,260	.....
Severely culled	.....	.....	80	.....	.....	.....	.....	.....	7,870	.....
Second growth	.....	.....	8,060	.....	12,418	.....	.....	.....	.....	.....
Young growth	.....	.....	.....	.....	.....	.....	380	.....	.....	.....
	180	0.4	8,520	13.3	12,946	24.7	380	2.0	11,130	24.9
2. Coniferous:										
Virgin and moderately culled	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Severely culled	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Second growth	1,450	.....	360	.....	.....	.....	590	.....	146	.....
Young growth	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	1,450	3.0	360	0.6	.....	.....	590	3.1	146	0.3
3. Mixed:										
Virgin and moderately culled	.....	.....	.....	.....	.....	.....	.....	.....	8,902	.....
Severely culled	.....	.....	575	.....	.....	.....	.....	.....	676	.....
Second growth	44,655	.....	19,020	.....	13,868	.....	725	.....	2,690	.....
Young growth	.....	.....	.....	.....	.....	.....	1,465	.....	.....	.....
	44,655	92.7	19,595	30.7	13,868	26.5	2,190	11.5	12,268	27.6
4. Poplar-Birch, 5 to 20 per cent. coniferous reproduction:										
Standards and poles	.....	.....	.....	.....	1,792	.....	390	.....	6,202	.....
Saplings	.....	.....	10,550	.....	286	.....	.....	.....	530	.....
	.....	.....	10,550	16.5	2,078	4.0	390	2.0	6,732	15.0
5. Poplar-Birch, without coniferous reproduction:										
Standards and poles	.....	.....	.....	.....	.....	.....	100	.....	1,666	.....
Saplings	1,890	.....	9,585	.....	7,782	.....	10,565	.....	5,818	.....
	1,890	3.9	9 585	15.0	7,782	14.8	10,665	56.2	7,484	16.7
III. Barrens	.....	.....	6,200	9.7	.....	.....	.....	.....	6,780	15.2
Land area investigated	48,175	.....	63,900	.....	52,400	.....	19,015	.....	44,688	.....

ALGONQUIN, GEORGIAN BAY, TRENT, FOREST SURVEY, 1921—CLASSIFICATION OF LANDS.—*Continued.*

	Butt		Biggar		Cameron		Cardwell		Calvin	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
I. Cleared Land					3,075	3.4	1,245	5.3	6,925	19.6
II. Forest:										
1. Hardwood:										
Virgin and moderately culled	14,605		4,740		2,285					
Severely culled			60							
Second growth					920					
Young growth					920					
	14,605	31.5	4,800	10.1	4,125	4.6				
2. Coniferous:										
Virgin and moderately culled	1,280									
Severely culled					1,430					
Second growth	300		990		3,055		160		80	
Young growth	325				2,280				140	
	1,905	4.1	990	2.1	6,765	7.5	160	0.7	220	0.6
3. Mixed:										
Virgin and moderately culled	17,410		16,870		1,785		10,150			
Severely culled	11,215		17,950		5,280					
Second growth					19,120		580		565	
Young growth					1,330					
	28,625	61.8	34,820	73.0	27,515	30.3	10,730	45.7	565	1.6
4. Poplar-Birch, 5 to 20 per cent. coniferous reproduction:										
Standards and poles					12,325				5,115	
Saplings					12,475				1,640	
					24,800	27.3			6,755	19.1
5. Poplar-Birch, without coniferous reproduction:										
Standards and poles									7,445	
Saplings	1,200		7,080		6,435		11,310		13,420	
	1,200	2.6	7,080	14.8	6,435	7.1	11,310	48.3	20,865	59.1
III. Barrens					17,980	19.8				
Land area investigated	46,335		47,690		90,695		23,445		35,330	

ALGONQUIN, GEORGIAN BAY, TRENT, FOREST SURVEY, 1921—CLASSIFICATION OF LANDS.—*Continued.*

	Canisbay		Carling		Chisholm		Christie		Clancy	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
I. Cleared Land			2,345	4.1	18,640	36.3	5,770	12.7		
II. Forest:										
1. Hardwood:										
Virgin and moderately culled			940				1,590			
Severely culled			5,995		12,105		7,775			
Second growth			2,660		160					
Young growth					100		825			
			9,595	16.8	12,365	24.0	10,190	22.3		
2. Coniferous:										
Virgin and moderately culled	355								1,690	
Severely culled										
Second growth			575						1,130	
Young growth					1,150					
	355	0.8	575	1.0	1,150	2.2			2,820	5.3
3. Mixed:										
Virgin and moderately culled	36,870								17,850	
Severely culled	110		540				15,405		480	
Second growth	3,290				1,180		435		15,870	
Young growth					100					
	40,270	88.4	540	0.9	1,280	2.5	15,840	34.9	34,200	64.0
4. Poplar-Birch, 5 to 20 per cent. coniferous reproduction:										
Standards and poles			110						10,775	
Saplings			9,400							
			9,510	16.7					10,775	20.1
5. Poplar-Birch without coniferous reproduction:										
Standards and poles										
Saplings	1,060		1,165		16,825		13,705		2,270	
	1,060	2.3	1,165	2.2	16,825	32.7	13,705	30.1	2,270	4.3
III. Barrens	3,850	8.5	33,255	58.3	1,170	2.3			3,390	6.3
Land area investigated	45,535		56,985		51,430		45,505		53,455	

ALGONQUIN, GEORGIAN BAY, TRENT, FOREST SURVEY, 1921—CLASSIFICATION OF LANDS.—*Continued.*

	Clara		Conger		Cowper		Croft		Deacon	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
I. Cleared Land	1,235	2.0	180	0.3			2,345	11.3	40	0.1
II. Forest:										
1. Hardwood:										
Virgin and moderately culled					500				9,865	
Severely culled							1,485			
Second growth	260						90			
Young growth	350									
	610	1.0			500	3.6	1,575	7.6	9,865	8.71
2. Coniferous:										
Virgin and moderately culled										
Severely culled										
Second growth	6,880		50		330				1,480	
Young growth	140									
	7,020	11.2	50	0.0	330	2.4			1,480	2.8
3. Mixed:										
Virgin and moderately culled							2,205		1,280	
Severely culled	3,170		7,830		40		2,035		5,210	
Second growth	10,150		13,515		1,165		4,350		5,720	
Young growth	650								3,835	
	13,970	22.4	21,345	40.4	1,205	8.6	8,590	41.5	16,045	30.5
4. Poplar-Birch, 5 to 20 per cent. coniferous reproduction:										
Standards and poles	15,175				445				7,045	
Saplings	7,255		2,415		7,720		875		3,445	
	22,430	35.9	2,415	4.6	8,165	58.2	875	4.2	10,490	20.0
5. Poplar-Birch, without coniferous reproduction:										
Standards and poles	2,155								14,405	
Saplings	7,425		20,005		3,815		1,690		260	
	9,580	15.3	20,005	38.0	3,815	27.2	1,690	8.2	14,665	27.9
III. Barrens	7,600	12.2	8,780	16.7			5,640	27.3		
Land area investigated	62,445		52,775		14,015		20,715		52,588	

ALGONQUIN, GEORGIAN BAY, TRENT, FOREST SURVEY, 1921—CLASSIFICATION OF LANDS.—*Continued.*

	Devine		Dickens		Dickson		Edgar		Ferguson	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
I. Cleared Land	155	0.3							210	1.0
II. Forest:										
1. Hardwood:										
Virgin and moderately culled	32,405				170				710	
Severely culled									1,290	
Second growth										
Young growth										
	32,405	68.2			170	0.4			2,000	9.5
2. Coniferous:										
Virgin and moderately culled					480					
Severely culled					1,560					
Second growth					960		4,610			
Young growth										
					3,000	6.8	4,610	8.6		
3. Mixed:										
Virgin and moderately culled	9 050		4,720		7,810					
Severely culled	1,005		1,510		4,625					
Second growth	1,865		1,570		28,025		27,280		645	
Young growth										
	11,920	25.1	7,800	20.4	40,460	92.1	27,280	51.3	645	3.1
4. Poplar-Birch, 5 to 20 per cent. coniferous reproduction:										
Standards and poles			1,890		320		18,350			
Saplings			1,210						4,160	
			3,100	8.1	320	0.7	18,350	34.5	4,160	19.6
5. Poplar-Birch, without coniferous reproduction:										
Standards and poles							2,320			
Saplings			9,980				675			
			9,980	26.1			2,995	5.6		
III. Barrens	3,060	6.4	17,290	45.4					14,150	66.8
Land area investigated	47,540		38,170		43,950		53,235		21,165	

ALGONQUIN, GEORGIAN BAY, TRENT, FOREST SURVEY, 1921—CLASSIFICATION OF LANDS.—*Continued.*

	Ferrie		Ferris		Finlayson		Fitzgerald		Fraser	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
I. Cleaked Land	955	2.0	11,755	18.7					2,918	5.4
II. Forest:										
1. Hardwood:										
Virgin and moderately culled	280				40,455		1,690		1,294	
Severely culled										
Second growth			930				2,910			
Young growth			80							
	280	0.6	1,010	1.6	40,455	76.7	4,600	8.8	1,294	2.4
2. Coniferous:										
Virgin and moderately culled	6,380									
Severely culled										
Second growth			100						328	
Young growth										
	6,380	13.0	100	.2					328	0.6
3. Mixed:										
Virgin and moderately culled	12,480				9,205		1,465			
Severely culled	2,035				1,390		470			
Second growth	10,535		3,575		1,515		16,270		350	
Young growth			1,550							
	25,050	51.2	5,125	8.1	12,110	22.9	18,205	34.8	350	0.6
4. Poplar-Birch, 5 to 20 per cent. coniferous reproduction:										
Standards and poles							13,470		916	
Saplings			1,980		190		14 060			
			1 980	3.1	190	0.4	27,530	52.7	916	1.7
5. Poplar-Birch, without coniferous reproduction:										
Standards and poles			1,260						3,414	
Saplings	300		41,730						44,468	
	300	0.6	42,990	68.3					47,882	88.7%
III. Barrens	15,915	32.6					1,955	3.7	308	0.0+
Land area investigated	48,880		62,960		52,755		52,290		53,990	

ALGONQUIN, GEORGIAN BAY, TRENT, FOREST SURVEY, 1921—CLASSIFICATION OF LANDS.—*Continued.*

	Franklin		Freeman		Freswick		Gibson		Grattan	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	
I. Cleared Land			560	1.0			890	1.6	27,556	67.
II. Forest:										
1. Hardwood:										
Virgin and moderately culled	1,510				350					
Severely culled									9,297	
Second growth										
Young growth									1,965	
	1,510	27.2			350	0.8			11,262	16.4
2. Coniferous:										
Virgin and moderately culled										
Severely culled										
Second growth					3,885				830	
Young growth									350	
					3,885	9.0			1,180	1.7
3. Mixed:										
Virgin and moderately culled					29,610		11,670		130	
Severely culled			5,390		570		6,190		1,050	
Second growth			24,640		4,510		6,175		3,580	
Young growth									720	
			30,030	55.7	34,690	80.1	24,035	43.9	5,480	8.0
4. Poplar-Birch, 5 to 20 per cent. coniferous reproduction:										
Standards and poles					3,650				2,975	
Saplings			600		390		21,975		11,585	
			600	1.1	4,040	9.3	21,975	40.1	14,560	21.2
5. Poplar-Birch, without coniferous reproduction:										
Standards and poles									1,700	
Saplings	4,040		15,460		350		7,725		6,990	
	4,040	72.8	15,460	28.7	350	0.8	7,725	14.1	8,690	12.6
III. Barrens			7,300	13.5			160	0.3		
Land area investigated	5,550		53,950		43,315		54,785		68,728	

ALGONQUIN, GEORGIAN BAY, TRENT, FOREST SURVEY, 1921 CLASSIFICATION OF LANDS.—*Continued.*

	Griffeith		Guthrie		Gurd		Hagarty		Hagerman	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
I. Cleared Land	3,685	8.1			5,585	19.7	26,722	47.3	5,725	12.5
II. Forest:										
1. Hardwood:										
Virgin and moderately culled			235		1,080		328		1,160	
Severely culled					4,725		120		3,600	
Second growth	2,180						240			
Young growth	760				4,860					
	2,940	6.4	235	0.4	10,665	37.6	688	1.2	4,760	10.4
2. Coniferous:										
Virgin and moderately culled							366			
Severely culled										
Second growth	140		7,790				1,622		2,560	
Young growth							128			
	140	0.3	7,790	13.3			2,116	3.8	2,560	5.6
3. Mixed:										
Virgin and moderately culled			6,595		1,855		1,690		4,960	
Severely culled	145				2,655		452		11,350	
Second growth	2,390				5,190		6,946		900	
Young growth							500			
	2,535	5.6	6,595	11.2	9,700	34.2	9,588	16.9	17,210	37.6
4. Poplar-Birch, 5 to 20 per cent. coniferous reproduction:										
Standards and poles			41,445				2,034			
Saplings	2,925						3,256			
	2,925	6.4	41,445	70.7			5,290	9.4		
5. Poplar-Birch without coniferous reproduction:										
Standards and poles					150		1,298			
Saplings	10,080		2,305		1,215		10,814		11,145	
	10,080	22.2	2,305	3.9	1,365	4.8	12,112	21.4	11,145	24.4
III. Barrens	23,200	51.0	270	0.5	1,065	3.7			4,360	9.5
Land area investigated	45,505		58,640		28,380		56,516		45,760	

ALGONQUIN, GEORGIAN BAY, TRENT, FOREST SURVEY, 1921—CLASSIFICATION OF LANDS.—*Continued.*

	Hardy		Harrison		Head		Himsworth		Hindon	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
I. Cleared Land	1,480	4.0			2,690	4.5	2,175	23.4	600	1.6
II. Forest:										
1. Hardwood:										
Virgin and moderately culled					1,780				8,580	
Severely culled	190		280							
Second growth							320			
Young growth										
	190	0.5	280	0.5	1,780	3.0	320	3.4	8,580	23.5
2. Coniferous:										
Virgin and moderately culled										
Severely culled	110		170		210					
Second growth	550				420					
Young growth	290		490							
	950	2.6	660	1.1	630	1.1				
3. Mixed:										
Virgin and moderately culled	17,585								20,340	
Severely culled	10,890		200		1,640					
Second growth	1,070		4,440		4,780		110			
Young growth	320		51,620							
	29,865	80.5	56,260	93.0	6,420	10.7	110	1.2	20,340	55.7
4. Poplar-Birch, 5 to 20 per cent. coniferous reproduction:										
Standards and poles					15,610					
Saplings			1,304		25,410					
			1,304	2.2	41,020	68.3				
5. Poplar-Birch, without coniferous reproduction:										
Standards and poles	220				900					
Saplings	3,420				3,185		4,440		7,010	
	3,640	9.8			4,085	6.8	4,440	47.8	7,010	19.2
III. Barrens	955	2.6	1,950	3.2	3,350	5.6	2,250	24.2		
Land area investigated	37,080		60,454		59,975		9,295		36,530	

ALGONQUIN, GEORGIAN BAY, TRENT, FOREST SURVEY, 1921—CLASSIFICATION OF LANDS.—*Continued.*

	Hunter		Joly		Jones		Laurier		Lauder	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
I. Cleared Land			720	2.2	3,548	11.6	1,545	3.8	640	1.8
II. Forest:										
1. Hardwood:										
Virgin and moderately culled	19,610		9,440		2,818		7,520		4,780	
Severely culled			2,960				4,130			
Second growth			8,560		104		9,590		90	
Young growth			130						50	
	19,610	41.9	21,090	64.1	2,922	9.6	21,240	52.1	4,920	13.7
2. Coniferous:										
Virgin and moderately culled	540									
Severely culled	190									
Second growth							955			
Young growth										
	730	1.6					955	2.3		
3. Mixed:										
Virgin and moderately culled	10,485		470		226				1,530	
Severely culled	970						1,425			
Second growth	525		570		224		845		3,035	
Young growth										
	11,980	25.6	1,040	3.1	450	1.7	2,270	5.6	4,565	12.8
4. Poplar-Birch, 5 to 20 per cent. coniferous reproduction:										
Standards and poles					1,478				14,755	
Saplings			140		1,682				235	
			140	0.5	3,160	10.1			14,990	41.8
5. Poplar-Birch, without coniferous reproduction:										
Standards and poles									2,110	
Saplings			6,030		9,722		14,780		1,480	
			6,030	18.3	9,722	31.8	14,780	36.2	3,590	10.0
III. Barrens	14,485	30.9	3,880	11.8	10,764	35.2			7,135	19.9
Land area investigated	46,805		32,900		30,566		40,790		35,840	

ALGONQUIN, GEORGIAN BAY, TRENT, FOREST SURVEY, 1921—CLASSIFICATION OF LANDS.—*Continued.*

	Lawrence		Lister		Livingstone		Lount		Lyndoch	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
I. Cleared Land	.....	.....	190	0.4	.....	.....	3,285	7.1	9,664	17.6
II. Forest:										
1. Hardwood:										
Virgin and moderately culled	8,640	.....	7,645	.....	9,295	.....	10,695	.....	2,220	.....
Severely culled	.....	.....	.....	.....	.....	.....	7,310	.....	.....	.....
Second growth	.....	.....	.....	.....	.....	.....	.....	.....	1,180	.....
Young growth	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	8,640	19.4	7,645	16.1	9,295	21.3	18,005	38.8	3,400	6.2
2. Coniferous:										
Virgin and moderately culled	120	.....	.....	.....	.....	.....	200	.....	.....	.....
Severely culled	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Second growth	.....	.....	3,390	.....	.....	.....	.....	.....	.....	.....
Young growth	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	120	0.3	3,390	7.2	.....	.....	200	0.4	.....	.....
3. Mixed:										
Virgin and moderately culled	34,075	.....	5,835	.....	28,330	.....	3,295	.....	25	.....
Severely culled	.....	.....	5,435	.....	5,025	.....	7,780	.....	.....	.....
Second growth	1,330	.....	7,650	.....	.....	.....	4,320	.....	11,340	.....
Young growth	.....	.....	.....	.....	.....	.....	155	.....	105	.....
	35,405	79.5	18,920	40.1	33,355	77.5	15,550	33.5	11,470	20.9
4. Poplar-Birch, 5 to 20 per cent. coniferous reproduction:										
Standards and poles	.....	.....	.....	.....	.....	.....	.....	.....	1,500	.....
Saplings	.....	.....	.....	.....	.....	.....	.....	.....	8,745	.....
	.....	.....	.....	.....	.....	.....	.....	.....	10,245	18.6
5. Poplar-Birch, without coniferous reproduction:										
Standards and poles	.....	.....	15,825	.....	.....	.....	1,960	.....	.....	.....
Saplings	.....	.....	1,330	.....	450	.....	5,945	.....	5,855	.....
	.....	.....	16,155	36.2	450	1.0	7,905	17.0	5,855	10.6
III. Barrens	360	0.8	.....	.....	80	0.2	1,465	3.2	14,335	26.1
Land area investigated	44,525	.....	47,300	.....	43,180	.....	46,410	.....	54,969	.....

ALGONQUIN, GEORGIAN BAY, TRENT, FOREST SURVEY, 1921—CLASSIFICATION OF LANDS. *Continued.*

	Lyell		McClintock		McConkey		McCraney		McKay	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
I. Cleared Land	1,566	3.6	240	0.6	1,495	3.0	...	...	...	...
II. Forest:										
1. Hardwood:										
Virgin and moderately culled	10,322		31,865		150		39,835		...	...
Severely culled	1,808		...		...		1,260		...	...
Second growth	590		...		...		...		...	...
Young growth	1,638		...		...		...		1,838	...
	14,358	33.0	31,865	73.0	150	0.3	41,095	88.2	1,838	6.9
2. Coniferous:										
Virgin and moderately culled	...	...	130	...	740	...	...	...	...	...
Severely culled	...	...	...	...	...	...	...	...	...	...
Second growth	...	...	...	...	...	...	270	...	...	...
Young growth	...	...	...	...	...	...	...	...	...	...
	...	...	130	0.3	740	1.5	270	0.6	...	...
3. Mixed:										
Virgin and moderately culled	2,240	...	4,850	...	18,990	...	780	...	...	...
Severely culled	...	...	300	...	6,320	...	2,545	...	...	...
Second growth	222	...	...	...	14,730	...	670	...	3,120	...
Young growth	...	...	100	...	...	...	...	...	1,280	...
	2,462	5.7	5,250	12.0	40,040	79.5	3,995	8.6	4,400	16.4
4. Poplar-Birch, 5 to 20 per cent. coniferous reproduction:										
Standards and poles	...	...	...	...	4,550	...	...	...	2,530	...
Saplings	216	...	...	...	...	...	...	...	...	...
	216	0.5	...	...	4,550	9.1	...	...	2,530	9.5
5. Poplar-Birch, without coniferous reproduction:										
Standards and poles	...	...	170	...	...	...	...	...	...	...
Saplings	3,006	...	5,990	...	1,800	...	...	...	17,946	...
	3,006	6.9	6,160	14.1	1,800	3.6	...	...	17,946	67.2
III. Barrens	21,906	50.3	...	...	1,525	3.0	1,240	2.6	...	...
Land area investigated	43,514	...	43,645	...	50,300	...	46,600	...	26,714	...

ALGONQUIN, GEORGIAN BAY, TRENT, FOREST SURVEY, 1921—CLASSIFICATION OF LANDS.—*Continued.*

	McKellar		McKenzie		McLaughlin		Machar		Maria	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
I. Cleared Land	7,800	17.3	2,280	5.1	30	0.0	2,140	15.5	595	0.9
II. Forest:										
1. Hardwood:										
Virgin and moderately culled					7,025		3,115		350	
Severely culled			570				4,180			
Second growth	1,410		625							
Young growth							1,825			
	1,410	3.1	1,195	2.7	7,025	16.1	9,120	65.9	350	0.5
2. Coniferous:										
Virgin and moderately culled					680				1,545	
Severely culled									140	
Second growth	200						235		2,955	
Young growth	225									
	425	0.9			680	1.6	235	1.7	4,640	6.8
3. Mixed:										
Virgin and moderately culled	6,540		12,550		19,595		255			
Severely culled	4,950		6,455				1,100			
Second growth	10,575						140		17,525	
Young growth			915						355	
	22,065	49.0	19,920	45.0	19,595	45.2	1,495	10.8	17,880	26.5
4. Poplar-Birch, 5 to 20 per cent. coniferous reproduction:										
Standards and poles									24,645	
Saplings	5,680								9,200	
	5,680	12.6							33,845	50.2
5. Poplar-Birch without coniferous reproduction:										
Standards and poles									2,155	
Saplings	7,700		2,210				770		7,650	
	7,700	17.1	2,210	5.0			770	5.6	9,805	14.5
III. Barrens			18,735	42.2	16,170	37.1	60	0.5	375	0.6
Land area investigated	45,080		44,340		43,500		13,820		67,490	

ALGONQUIN, GEORGIAN BAY, TRENT, FOREST SURVEY, 1921—CLASSIFICATION OF LANDS. *Continued.*

	Master		McLean		Matawatchan		Mills		Monteith	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
I. Cleared Land			580	7.6	7,190	16.2	4,530	9.9	440	3.3
II. Forest:										
1. Hardwood:										
Virgin and moderately culled	1,540		2,410		1,410					
Severely culled										
Second growth					5,160					
Young growth					360					
	1,540	2.8	2,410	31.6	6,930	15.6				
2. Coniferous:										
Virgin and moderately culled										
Severely culled										
Second growth	400				1,000					
Young growth										
	400	0.7			1,000	2.3				
3. Mixed:										
Virgin and moderately culled	1,550				830		13,980			
Severely culled	1,000						13,670			
Second growth	4,725				13,775		220		6,530	
Young growth	490									
	7,765	13.8			14,605	33.0	27,870	60.7	6,530	49.3
4. Poplar-Birch, 5 to 20 per cent. coniferous reproduction:										
Standards and poles	3,075				6,570					
Saplings	1,885				1,910					
5. Poplar-Birch, without coniferous reproduction:	4,960	8.9			8,480	19.1				
Standards and poles	14,300						340			
Saplings	27,010		4,650		5,925		425		6,280	
	41,310	73.8	4,650	60.8	5,925	13.3	765	1.7	6,280	47.4
III. Barrens					220	0.5	12,760	27.7		
Land area investigated	55,975		7,640		44,350		45,925		13,250	

ALGONQUIN, GEORGIAN BAY, TRENT, FOREST SURVEY, 1921—CLASSIFICATION OF LANDS.—*Continued.*

	Mowatt		Murchison		Nightingale		Nipissing		Niven	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
I. Cleared Land	315	0.5	1,085	2.4	30	0.0	670	4.6		
II. Forest:										
1. Hardwood:										
Virgin and moderately culled	1,795		820		10,235		180			
Severely culled	6,430		1,710							
Second growth										
Young growth										
	8,225	11.0	2,530	5.5	10,235	25.0	180	1.2		
2. Coniferous:										
Virgin and moderately culled	7,020									
Severely culled										
Second growth	1,380				1,285				950	
Young growth										
	8,400	11.2			1,285	3.1			950	1.8
3. Mixed:										
Virgin and moderately culled	3,490		1,760		14,360		1,350		805	
Severely culled	3,820		3,995							
Second growth	17,725		400		1,805				22,375	
Young growth					300				530	
	25,035	33.4	6,155	13.6	16,465	40.3	1,350	9.4	23,710	45.2
4. Poplar-Birch, 5 to 20 per cent. coniferous reproduction:										
Standards and poles	370		2,985		350				19,095	
Saplings	5,590				225				7,840	
	5,960	7.9	2,985	6.6	575	1.4			26,935	51.4
5. Poplar-Birch, without coniferous reproduction:										
Standards and poles										
Saplings	11,815		12,300				12,220		500	
	11,815	15.8	12,300	27.1			12,220	84.8	500	1.0
III. Barrens	15,135	20.2	20,325	44.8	12,385	30.2			310	0.6
Land area investigated	74,885		45,380		40,975		14,420		52,405	

ALGONQUIN, GEORGIAN BAY, TRENT, FOREST SURVEY, 1921—CLASSIFICATION OF LANDS.—*Continued.*

	Oakley		Osler		Papineau		Patterson		Paxton	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
I. Cleared Land	1,415	4.4			6,300	12.7	4,250	6.4		
II. Forest:										
1. Hardwood:										
Virgin and moderately culled	23,295		4,660				6,815		16,600	
Severely culled							1,630		350	
Second growth										
Young growth										
	23,295	72.4	4,660	10.0			8,445	12.7	16,950	35.0
2. Coniferous:										
Virgin and moderately culled							2,265			
Severely culled							250			
Second growth			945		780		300		1,205	
Young growth										
			945	2.0	780	1.6	2,815	4.2	1,205	2.5
3. Mixed:										
Virgin and moderately culled	795		8,030				7,105		4,405	
Severely culled			6,375		135		2,005		19,935	
Second growth	1,170		12,550		4,635		8,985			
Young growth			690		1,140				185	
	1,965	6.1	27,645	59.1	5,910	11.9	18,095	27.0	24,525	50.7
4. Poplar-Birch, 5 to 20 per cent. coniferous reproduction:										
Standards and poles			2,735		3,105					
Saplings					11,775		4,250			
			2,735	5.8	14,880	30.0	4,250	6.4		
5. Poplar-Birch, without coniferous reproduction:										
Standards and poles			10,150		105				145	
Saplings	5,520		665		18,020		22,480		5,560	
	5,520	17.1	10,815	23.1	18,125	36.6	22,480	33.7	5,705	11.8
III. Barrens					3,550	7.2	6,405	9.6		
Land area investigated	32,195		46,800		49,545		66,740		48,385	

ALGONQUIN, GEORGIAN BAY, TRENT, FOREST SURVEY, 1921—CLASSIFICATION OF LANDS.—*Continued*

	Peck		Pentland		Petawawa		Preston		Pringle	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
I. Cleared Land					11,050	51.1	105	0.2	5,065	10.6
II. Forest:										
1. Hardwood:										
Virgin and moderately culled	10,930		15,715				1,965		2,780	
Severely culled					135				5,215	
Second growth										
Young growth										
	10,930	25.4	15,715	29.0	135	0.6	1,965	4.2	7,995	16.7
2. Coniferous:										
Virgin and moderately culled			80				7,295			
Severely culled							185			
Second growth			690		2,050		270		65	
Young growth										
			770	1.4	2,050	9.5	7,750	16.6	65	0.1
3. Mixed:										
Virgin and moderately culled	27,830		23,275				18,320		21,275	
Severely culled			830				5,565		4,010	
Second growth	440		2,720				4,055		1,620	
Young growth			385		1,245					
	28,270	66.0	27,210	50.3	1,245	5.8	27,940	60.0	26,905	56.1
4. Poplar-Birch, 5 to 20 per cent. coniferous reproduction:										
Standards and poles			190				375		165	
Saplings										
			190	0.4			375	0.8	165	0.4
5. Poplar-Birch, without coniferous reproduction:										
Standards and poles			3,005						2,810	
Saplings	3,665		7,215		7,125		1,910		695	
	3,665	8.6	10,220	18.9	7,125	33.0	1,910	4.1	3,505	7.3
III. Barrens							6,580	14.1	4,285	8.8
Land area investigated	42,865		54,105		21,605		46,625		47,985	

ALGONQUIN, GEORGIAN BAY, TRENT, FOREST SURVEY, 1921—CLASSIFICATION OF LANDS. *Continued.*

	Proudfoot		Radcliffe		Raglan		Richards		Ridout	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
I. Cleared Land	2,640	6.1	6,256	14.7	14,262	21.7	4,500	10.6	295	1.0
II. Forest:										
1. Hardwood:										
Virgin and moderately culled	3,170		3,505		6,486				16,560	
Severely culled	5,575		114						1,890	
Second growth	6,065		1,275		1,254					
Young growth			1,120							
	14,810	34.0	6,014	14.2	7,740	11.8			18,450	64.3
2. Coniferous:										
Virgin and moderately culled							2,175			
Severely culled										
Second growth	470		755				935			
Young growth										
	470	1.1	755	1.7			3,110	7.4		
3. Mixed:										
Virgin and moderately culled	14,095		1,910		914				4,730	
Severely culled	970				1,675		160		80	
Second growth	1,635		3,731		18,214		380			
Young growth										
	16,700	38.4	5,641	13.3	20,803	31.6	540	1.3	4,810	16.0
4. Poplar-Birch, 5 to 20 per cent. coniferous reproduction:										
Standards and poles			796		554		365			
Saplings			435		10,140		300		90	
			1,231	2.9	10,694	16.2	665	1.6	90	0.3
5. Poplar-Birch without coniferous reproduction:										
Standards and poles	255		2,495							
Saplings	8,645		14,225		9,890		26,910		5,015	
	8,900	20.4	16,720	39.4	9,890	15.0	26,910	63.6	5,015	17.3
III. Barrens			5,855	13.8	2,430	3.7	6,545	15.5	25	0.1
Land area investigated	43,520		42,472		65,819		42,270		28,685	

ALGONQUIN, GEORGIAN BAY, TRENT, FOREST SURVEY, 1921—CLASSIFICATION OF LANDS.—*Continued.*

	Rolph		Sabine		Sebastopol		Shawanaga		Sherborne	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
I. Cleared Land	3,930	9.3	880	1.7	12,230	28.8	.....	.....	670	2.4
II. Forest:										
1. Hardwood:										
Virgin and moderately culled	.....	.....	21,600	.....	100	.....	.....	.....	6,460	.....
Severely culled	115	.....	17,795	.....	21,430	.....	.....	.....	1,320	.....
Second growth	1 140	.....	.....	.....	.....	.....	.....	.....	.....	.....
Young growth	.....	.....	3,710	.....	.....	.....	.....	.....	.....	.....
	1,255	2.9	43,105	84.5	21,530	50.6	.....	.....	7,780	29.1
2. Coniferous:										
Virgin and moderately culled	250	.....	.....	.....	.....	.....	.....	.....	.....	.....
Severely culled	350	.....	.....	.....	.....	.....	.....	.....	.....	.....
Second growth	2,425	.....	50	.....	.....	.....	.....	.....	130	.....
Young growth	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	3,025	7.1	50	0.1	.....	.....	.....	.....	130	0.5
3. Mixed:										
Virgin and moderately culled	570	.....	70	.....	.....	.....	.....	.....	1,105	.....
Severely culled	1,210	.....	1,180	.....	.....	.....	1,190	.....	.....	.....
Second growth	9,600	.....	.....	.....	.....	.....	230	.....	160	.....
Young growth	.....	.....	.....	.....	1,455	.....	10,230	.....	.....	.....
	11,380	26.9	1,250	2.5	1 455	3.4	11,650	40.4	1,265	4.7
4. Poplar-Birch, 5 to 20 per cent. coniferous reproduction:										
Standards and poles	2,995	.....	.....	.....	.....	.....	.....	.....	.....	.....
Saplings	8,220	.....	.....	.....	6,430	.....	8,620	.....	375	.....
	11,215	26.7	.....	.....	6,430	15.1	8,260	29.9	375	1.4
5. Poplar-Birch, without coniferous reproduction:										
Standards and poles	3,130	.....	.....	.....	.....	.....	.....	.....	.....	.....
Saplings	7,415	.....	300	.....	865	.....	.....	.....	16,400	.....
	10,545	24.9	300	0.6	865	2.1	.....	.....	16,400	61.9
III. Barrens	940	2.2	5,420	10.6	.....	.....	8,510	29.7	.....	.....
Land area investigated	42,290	.....	51,005	.....	42,510	.....	28,780	.....	26,620	.....

ALGONQUIN, GEORGIAN BAY, TRENT, FOREST SURVEY, 1921—CLASSIFICATION OF LANDS.—*Continued.*

	Sherwood		Sinclair		Sproule		Stratton		Wallbridge	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
I. Cleared Land	9,488	20.8	70	0.8					730	1.1
II. Forest:										
1. Hardwood:										
Virgin and moderately culled			7,780		1,100		1,725			
Severely culled	650		740						360	
Second growth	92									
Young growth										
	742	1.6	8,520	92.4	1,100	2.5	1,725	2.9	360	0.5
2. Coniferous:										
Virgin and moderately culled					1,590					
Severely culled										
Second growth					415		6,545		4,250	
Young growth									400	
					2,005	4.5	6,545	11.0	4,650	6.7
3. Mixed:										
Virgin and moderately culled					17,730					
Severely culled	132									
Second growth	1,892		630		1,550		16,990			
Young growth							4,220		24,445	
	2,024	4.5	630	6.8	19,280	42.8	21,210	35.7	24,445	35.5
4. Poplar-Birch, 5 to 20 per cent. coniferous reproduction:										
Standards and poles	1,774						16,280			
Saplings	710				155				1,300	
	2,484	5.5			155	0.3	16,280	27.4	1,300	1.9
5. Poplar-Birch, without coniferous reproduction:										
Standards and poles	6,212						5,210			
Saplings	22,614				700		8,470		3,240	
	28,826	63.3			700	1.5	13,680	23.0	3,240	4.7
III. Barrens	1,948	4.3			21,755	48.4			34,125	49.6
Land area investigated	45,512		9,220		44,995		59,440		68,850	

ALGONQUIN, GEORGIAN BAY, TRENT, FOREST SURVEY, 1921—CLASSIFICATION OF LANDS.—*Continued.*

	White		Wilberforce		Wilkes		Wilson		Wylie		Wood	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
I. Cleared Land			30,665	50.4	55	0.1	1,570	3.8	2,660	11.3	525	1.0
II. Forest:												
1. Hardwood:												
Virgin and moderately culled			250		8,260		205					
Severely culled					240							
Second growth	350								275		60	
Young growth												
	350	0.7	250	0.4	8,500	19.9	205	0.5	275	1.2	60	0.1
2. Coniferous:												
Virgin and moderately culled					475							
Severely culled					190							
Second growth	7,455		2,085		1,710				3,465		210	
Young growth	845		160									
	8,300	16.0	2,245	3.7	2,375	5.6			3,465	14.7	210	0.4
3. Mixed:												
Virgin and moderately culled			190		24,860		9,115		170		275	
Severely culled			6,750		1,110		6,625					
Second growth	24,650		3,370		5,045		200		4,040		10,035	
Young growth			13,430				2,330					
	24,650	47.7	23,740	39.0	31,015	72.7	18,270	43.7	4,210	17.9	10,310	20.5
4. Poplar-Birch, 5 to 20 per cent. coniferous reproduction:												
Standards and poles	3,630		220		120				2,860		750	
Saplings	10,540								1,350		3,900	
	14,170	27.4	220	0.4	120	0.3			4,210	17.9	4,650	9.2
5. Poplar-Birch, without coniferous reproduction:												
Standards and poles	225		1,230		120				2,465		640	
Saplings	4,030		2,500		480				5,280		32,295	
	4,255	8.2	3,730	6.1	600	1.4			7,745	32.9	32,935	65.4
III. Barrens							21,710	52.0	970	4.1	1,690	3.4
Land area investigated	51,725		60,850		42,665		41,755		23,535		50,380	

ALGONQUIN, GEORGIAN BAY TRENT, FOREST SURVEY, 1920—1921—CLASSIFICATION OF LANDS BY DISTRICTS.

	Algonquin Park		Ottawa Valley		Renfrew		Madawaska 1920—21	
	Acres	%	Acres	%	Acres	%	Acres	%
I. Cleared Land	1,065	0.6	85,625	11.2	150,522	20.9	398,002	18.1
II. Forest:								
1. Hardwood:								
Virgin and moderately culled	309,090	17.0	25,180	3.3	41,742	5.8	162,729	7.4
Severely culled	8,200	0.5	13,610	1.8	34,768	4.8	104,988	4.8
Second growth	3,620	0.2	6,905	0.9	1,220	0.2	61,203	2.8
Young growth	490	.....	2,735	0.4	7,296	1.0	46,613	2.1
	321,400	17.7	48,430	6.4	85,026	11.8	375,533	17.1
2. Coniferous:								
Virgin and moderately culled	15,953	0.9	1,795	0.2	2,681	0.4	9,166	0.4
Severely culled	3,030	0.2	2,130	0.3	745	0.1	20,800	0.9
Second growth	59,220	3.4	21,715	2.9	9,494	1.3	12,304	0.6
Young growth	2,625	0.1	3,800	0.5	922	0.1	615	.....
	80,828	4.6	29,440	3.9	13,842	1.9	42,885	1.9
3. Mixed:								
Virgin and moderately culled	460,205	26.1	8,030	1.1	19,798	2.8	78,515	3.6
Severely culled	97,490	5.5	13 405	1.8	18,032	2.5	55,178	2.5
Second growth	323,464	18.3	92,805	12.2	36,216	5.0	176,265	8.0
Young growth	12,145	0.7	7,855	1.0	18,991	2.7	5,409	0.3
	893,304	50.6	122,095	16.1	93,037	13.0	315,367	14.4
4. Poplar-Birch, 5 to 20 per cent. coniferous reproduction:								
Standards and poles	160,475	9.2	111,495	14.6	22,883	3.2	84,035	3.8
Saplings	39,785	2.3	84,950	11.1	10,154	1.4	418,846	19.1
	200,260	11.5	196 445	25.7	33,037	4.6	502,881	22.9
5. Poplar-Birch, without coniferous reproduction:								
Standards and poles	70,210	4.0	27,005	3.5	24,678	3.4	15,049	0.7
Saplings	91,605	5.1	175,195	23.0	195,098	27.1	368,192	16.7
	161,815	9.1	202,200	26.5	219,776	30.5	383,241	17.4
III. Barrens	103,155	5.9	77,660	10.2	125,576	17.3	180,201	8.2
Land area investigated	1,761,827	.....	761,895	.....	720,816	.....	2,198,110	.....

ALGONQUIN, GEORGIAN BAY, TRENT, FOREST SURVEY, 1920—1921 CLASSIFICATION OF LANDS BY DISTRICTS.—*Concluded.*

	Muskoka		Parry Sound		Georgian Bay		Totals		
	Acres	%	Acres	%	Acres	%	Acres	%	%
I. Cleared Land	3,630	2.5	66,505	7.3	7,640	1.1	712,989	9.9	(79.2)
II. Forest:									
1. Hardwood:									
Virgin and moderately culled	66,595	45.5	67,385	7.3	6,655	0.9	679,376	9.4	(11.9)
Severely culled	3,950	2.7	68,345	7.4	14,705	2.1	248,566	3.4	(4.3)
Second growth	.....	.....	26,660	2.9	5,095	0.7	104,703	1.5	(1.8)
Young growth	.....	.....	7,640	0.8	.....	.....	64,774	0.9	(1.1)
	70,545	48.2	170,030	18.4	26,455	3.7	1,097,419	15.2	(19.1)
2. Coniferous:									
Virgin and moderately culled	.....	.....	15,035	1.6	7,020	1.0	51,650	0.7	(0.9)
Severely culled	.....	.....	560	0.1	170	.....	27,435	0.4	(0.5)
Second growth	130	0.1	8,315	0.9	7,305	1.1	118,483	1.6	(2.1)
Young growth	.....	.....	515	0.1	890	0.1	9,367	0.1	(0.2)
	130	0.1	24,425	2.7	15,385	2.2	206,935	2.8	(3.7)
3. Mixed:									
Virgin and moderately culled	26,970	18.4	162,425	17.7	20,570	2.9	776,513	10.8	(13.6)
Severely culled	80	0.1	103,800	11.3	42,580	6.0	330,565	4.6	(5.8)
Second growth	1,960	1.3	112,100	12.2	100,560	14.2	843,370	11.7	(14.8)
Young growth	.....	.....	3,720	0.4	88,035	12.5	136,155	1.9	(2.4)
	29,010	19.8	382,045	41.6	251,745	35.6	2,086,603	29.0	(36.6)
4. Poplar-Birch, 5 to 20 per cent. coniferous reproduction:									
Standards and poles	.....	.....	4,715	0.5	2,635	0.4	386,238	5.4	(6.8)
Saplings	465	0.3	16,415	1.8	79,854	11.3	650,469	9.0	(11.4)
	465	0.3	21,130	2.3	82,489	11.7	1,036,707	14.4	(18.2)
5. Poplar-Birch without coniferous reproduction:									
Standards and poles	.....	.....	5,735	0.6	640	0.1	143,317	2.0	(2.5)
Saplings	42,635	29.1	140,935	15.4	125,650	17.8	1,139,310	15.8	(19.9)
	42,635	29.1	146,770	16.0	126,290	17.9	1,282,627	17.8	(22.4)
III. Barrens	25	.....	107,125	11.7	196,350	27.8	790,092	10.9	
Land area investigated	146,440	.....	917,930	.....	706,354	.....	7,213,372	.....	.....

(Percentage figures in parentheses denote the participation of each forest type in the total forest area.)

Aerial Forest Survey.—The survey covered by the following report was undertaken by the Ontario Forestry Branch in co-operation with the Canadian Air Board for the purpose of determining the possibility of using air craft in connection with forest field work, and was carried on from Sioux Lookout, a western divisional point on the north line of the C.N.R. (G.T.P.), from March to October of the current year. During this time approximately 10,000 square miles was worked over, comprising in general the territory lying between the G.T.P. railway and the Lake St. Joseph - Lac Seul - English River waterway, from the Manitoba boundary east to the foot of Lake St. Joseph.

1. *Personnel.*—One station superintendent and pilot, two pilots, one chief mechanic, one storesman, one photographer, two engine fitters, one rigger, one boat builder, one clerk-stenographer, one cook and one cookie, furnished by the Air Board. The Forestry Branch observers were one forester and one student assistant.

2. *Equipment.*—One F.3. Flying Boat, two H.S.2.L. Flying Boats, one small motor boat, one row boat, four box cars (used for photographic dark room and store room, sleeping quarters, office, cookhouse and storage), technical stores and photographic equipment including two wind motors, two vertical aerial cameras (Kodak Company Type K.1.), one oblique camera, and one ground camera; compasses, chains, calipers, etc., and general office equipment.

3. *Characteristics of Machines.*—Some details of the more important characteristics of the types of air craft used, is perhaps necessary at this point for a correct comprehension of operating conditions.

The F.3. Flying Boat is a very large British machine, measuring over one hundred feet along the leading edge of the top plane; is capable of carrying up to a dozen men, and can fly for over six hours without refueling. Air speed is from seventy to eighty knots (80 to 90 miles per hour) and time to reach five thousand feet about thirty minutes. Although the splendid visibility from the observer's cockpit and the machine's ability to remain in the air for such a long time, were both points in favor of its use for the summer's work, such advantages in the air were more than offset by the difficulty of manoeuvring on the comparatively small lakes of the district. The machine was, therefore, the opportunity arising, exchanged for a third H.S.2.L. with the Victoria Beach (Lake Winnipeg) Air Station.

The H.S.2.L. is a Flying Boat of American design, considerably smaller than the F.3., seventy feet across the leading edge of the top plane; is capable of carrying up to five men, and of flying for about three and one-half hours without refueling. Air speed is between fifty-five and sixty-five knots (60 to 70 miles per hour), with time to climb three thousand feet about forty-five minutes. It will thus be seen that the H.S.2.L. has not as good a performance as that of the larger F.3. It has, however, advantages. Visibility from the observer's cockpit is better, and as it has only one engine and the F.3. requires two for sustained flight, the chances of trouble from this source are practically halved. But it is on the water, and not in flight, that the H.S.2.L.'s peculiar advantages become apparent. Here the machine is comparatively easy to manoeuvre, and because of its sturdy construction - which is, no doubt, largely responsible for its poor performance - can venture landings on unknown beaches and, in general, withstand, much better than a more finely built machine, the accidental ill-treatment which inevitably occurs under field conditions.

4. *Working Conditions.*—Weather, the lack of local arrangements in connection with the establishment of an Air Station and finally the erecting,

launching and testing the machines did not permit of regular flying until late in May. From the outset, as had been confidently expected, it was apparent that, largely because of the simple composition of the forest in this latitude, type mapping could be carried on without further experience, in so far as the separation of timber species and barren areas was concerned. These first flights served also to show, what was amply borne out by subsequent experience, that the country presented a very excellent flying chance, being liberally sprinkled with fairly large and well-connected lakes and free from any great land elevations. Thus, the limitations of low performance were largely offset, making it possible to fly with confidence and safety literally anywhere; and it should be borne in mind that the successful operation of low performance machines cannot be counted on without such favorable conditions. Flying and forest conditions having thus been found suitable, and as the separation of timber types and non-commercial areas was all the information required over a large area, typing on this basis was commenced about June 4, and carried on during the remainder of June and July. Weather conditions were ideal for flying, so that by August 2, the mapping of some fifty thousand square miles was completed to show the following types:

(1) Coniferous stands, 75 per cent. of better coniferous species;
(2) Mixed stands, less than 75 per cent. hardwood;
(3) Burned-over areas partially restocking.

5. *Mapping Methods.*—The system of mapping outlined below, was also developed during this period, and was used throughout the season.

The region being entirely unsurveyed—it might be said unexplored, if the main canoe routes of the Hudson Bay Company were excluded—township sheets for field sketching were not available, and it became necessary to prepare field sheets. This was done by plotting the information recorded on the eight mile to the inch Dominion Standard Topography Sheet for the region, to a suitable scale, the scale finally adopted being one inch to the mile. Field sheets, prepared as above, were attached to a drawing board and taken into the air. Here, just as in ground work, the chief consideration in mapping is to locate and orient the map. On the ground, by recognized survey methods, this can be done either by scaling off a known distance on the line being run and orienting by compass and back sight, or by orienting and intersecting for position on points whose location is already known. In the air, location, in the past season's operations and under aerial conditions generally, cannot be had by the use of the most orthodox ground method, i.e., traveling on a line whose length and direction are known. It should not be inferred from this that aerial navigation is discredited, but it requires the constant attention of a skilled navigator, besides the pilot, supplied with an assortment of complicated instruments. Moreover, calculations are necessary, even with the fullest instrumental equipment at present available; and the delay thus entailed, however small, is a distinct drawback in aerial sketch work. On the other hand, because of the greater number of such features, which can be seen at one and the same time, position by reference to known physiographic features can be obtained in flight more rapidly, accurately and easily than in the great majority of cases on the ground. On the same basis and for similar reasons, type lines can also be drawn in flight at a distinct advantage. In consideration of the foregoing, mapping, during the past season, was carried on almost exclusively by reference.

6. *Results.*—The mapping of the area mentioned above, which had been originally considered a season's work, having been completed in less time than expected (August 2), and the method and results having proved so satisfactory, plans were made for an extension of the survey. It was decided not only to continue typing of the adjoining territory, but also to attempt a classification of the three composition types into age or size classes.

By October 12, when weather conditions stopped field work, an additional area of almost equal size, bringing a total for the season up to approximately 10,000 square miles, was mapped to show in the three composition types, mentioned above, four size classes, viz.:

(1) Mature stands, at least 75 per cent. of trees of commercial size.
(2) Pole wood stands, not over twenty-five per cent. of commercial size.
(3) Sapling growth, no trees of commercial size.
(4) Reproduction, not over 3 feet in height.

This was worked out by landings to relate the appearance from the air to the actual condition of the stand as determined by ground work. Wherever possible, during such landings, sample plots of the types were laid out and measurements recorded. Results in this connection were extremely gratifying, and in twenty-one landings, a total for the season, including thirteen where sample plots were taken, no single case occurred in which the aerial classification differed materially from conditions as actually found on the ground.

The 10,000 square miles (6,400,000 acres) mapped, showed the forest condition as a whole to be approximately one-quarter of the coniferous type, one-third of the mixed type, and the remainder a burned-over type more or less restocking.

The coniferous type was defined as 75 per cent. or better coniferous, the species being white and black spruce, jack pine and balsam. The mixed type consisted of these species with poplar and birch. The original attempt to differentiate poplar-birch stands, as a separate type, proved not feasible. The burned-over type included only those areas where the second growth is mainly still below commercial size; it was estimated that three-quarters of such areas are restocking in some degree.

While opportunities for ground study were very limited, as can be seen by the small number of sample plots below, a few general remarks may be of interest.

The species composition, throughout the whole area covered, is very simple. Jack pine, black and white spruce, balsam, birch and poplar make up over ninety per cent. of the tree growth. White cedar occurs frequently in a dwarfed condition along the lake and river margins. Red maple, American elm, and black ash occurred occasionally. The proportion of white and red pine is very much less than the favorite method of travel in the country—that is, by water—would indicate. South of the G.T.P., red and white pine occur very frequently on lake and river margins, and from the main line of the C.P.R. become rapidly prominent, until at the international boundary, they are found interspersed with birch and poplar in extensive stands and splendid development. North of the G.T.P. (the region to which this survey relates) however, they rapidly disappear, even on small islands and lake shores; and the most northerly point at which white pine was noted, is not far from Sioux Lookout, on the English River, above Lac Seul. It is, however, highly probable that scattered bluffs and fringes would be found on the more southerly portions of

this lake, although a landing on the north-east shore showed no signs of the species, either on the shore or islands. Red pine is known to occur somewhat farther north, a bluff of perhaps five acres being noted at the head waters of the Albany drainage, on a sandy slope between Upper and Middle Green Grass Lakes. Unlike a species approaching its climatic limit, these northerly specimens of both white and red pine retain to a very marked degree, the vigorous appearance of their race and indeed appear to be much less affected by adverse climatic conditions than the other regional species. The above circumstances and the occurrence of these trees in isolated clumps, lend color to the tradition which is common among the lumbermen and early settlers of this region, that their commercial range at one time extended much further north —indeed, to Hudson Bay—and that the present distribution is due to a widespread fire or series of fires occurring from fifty to one hundred and fifty years ago. That fire would wholly consume every trace of such a forest over such an area seems improbable. Whatever the composition of the forest may have been in former times however, it would appear that the present species composition, if undisturbed, will, within a single generation of trees, show a tremendous increase in the percentage of balsam fir. Everywhere, on all sites and under dominant stands of every species, one is impressed by the prevalence and thrifty growth of balsam reproduction, which often forms a complete waist or knee-high canopy, almost totally weeding out rival reproduction and even undergrowth.

There is in this northern forest ample evidence of the severity of the climate. Mature stands of white spruce, which is the largest timber tree in the region, are almost invariably filled with the trunks and debris of wind-thrown specimens. This is believed to be due however, not so directly to the severe wind storms of the region, as to the weakening of trunks due to a very widespread condition of heartrot. In this connection, one may record that frost crack is extremely common. While such destruction is perhaps most easily seen in the case of mature white spruce, it is also to be found in mature stands of all the timber species; more particularly in the northern part of the region covered. Under such conditions, stands below maturity, produce far more and more valuable timber.

It is believed, too, that the effects of climate can be seen in the behaviour of the reproduction, more particularly as Lake St. Joseph is approached. Areas in this region, when burned over, very frequently pass through a somewhat different cycle than that obtaining for similar sites under more favorable climatic conditions. South of Lake Nippissing, for example, such sites are within three or four years, completely covered with a growth of tree seedlings typically poplar and birch. Here, however, although sites and chances of seeding, etc., seemed at least to be equally favorable, such areas very frequently were found with willow, alder, and other shrubby growths among which reproduction of tree species was sparsely interspersed.

7. *Aerial Photography.*—As aerial photography is a highly specialized process requiring definite equipment for definite objects, it could only be used experimentally during the past season. With this in view, some twenty-two hundred vertical and three hundred oblique exposures were made.

As pictures, oblique aerial exposures are, perhaps, more interesting and, at first sight, more instructive than verticals, being readily comparable to ground views from high buildings and land elevations. As the camera producing them is a fairly simple instrument, they are also easier to obtain. Such

pictures are valuable as permanent records of important aerial observations and as a substitute for lengthy descriptions of forest conditions. For mapping purposes, however, they are of little use.

Vertical pictures, on the other hand, while they are not artistic or interesting at first sight as pictures, can be used for mapping and type classifying. The cameras making such exposures are, however, delicate and complicated instruments. In operation, they are fixed to the machine, and can be made to produce, either automatically or by a simple operation, exposures at such a rate that each succeeding exposure will cover a certain proportion (greater or less as desired) of the territory covered by the exposure preceding it. By thus including a part of one picture in another—or "overlapping"—it becomes possible to "join" one to another and build up a composite picture containing any number of single exposures. The accurate joining of two pictures of this kind is not, however, as simple a matter as might be supposed from the foregoing, which takes no account of the motion of the machine during exposure. Such motion, the effects of which must be corrected by dark room work and which might be compared to that of a ship—sometimes slowly rising and falling, as if riding on the long, gentle swell of an aerial ocean; sometimes rolled sharply from side to side or pitched fore and aft—continually and unavoidably violates the requirements for exact similarity in the scale of overlapping pictures—namely, that exposure be made at exactly the same height and with fore and aft and lateral axis either level or at the same degree of departure from level. While the differences arising from the above causes are usually small in each separate case, the total effect over a series of hundreds of pictures may produce great inaccuracy. Nor is the motion of the machine the only element affecting the accuracy of aerial photographic survey, for even in perfectly built up strips, where point has been made to correspond with point exactly in the overlap, there is still the error due to the natural differences in ground elevation. Unfortunately, such errors require for their correction, besides laboratory work, a certain amount of ground survey work, which shall be visible in the picture and whose details can be plotted and used as a check. Errors arising from the foregoing however, do not have to be seriously reckoned with in a flat country, and where absolute accuracy is not essential.

Results of this year's work would indicate that satisfactory pictures can be produced which will show sufficient detail to separate types; but it would appear that before this possibility can be utilized to any great extent, it will be necessary to accumulate a photographic reference library of known forest growths as a basis of comparison, and also to devise a satisfactory method of joining the strips of pictures to one another to make a mosaic. Such joining is not a matter of the operation of a mechanical device, as in the joining of successive pictures to make a strip, but is dependent on the ability of the pilot to fly his machine along evenly spaced parallel courses, so as to cause the long edges of the strips to join—a very different and more difficult undertaking. Corrections for differences in ground elevation and motion of the machine must be made in this connection, just as with the sections of each strip.

Despite the difficulties outlined above, the use of aerial photography for mapping would appear to be an almost certain development in survey work. Its ability to reproduce detail is unlimited; it can also produce results rapidly and with a degree of completeness, the value of which can hardly be appreciated without experience.

8. *Fire Patrol.*—Detection of forest fires was carried on during the fire

season in connection with the regular survey work, location being reported on return to the base, to the local rangers or by wire to the district chief. From the season's flying experience, it would appear that aerial detection of fire is both more reliable and more efficient than any other system as yet devised. On the score of reliability, records of the field unit of three machines, with which the past season's work was carried on, show that it would have been possible throughout the season to provide a daily patrol of at least one machine capable of covering a two hundred mile beat. This is the more creditable when it is considered that flight was continued without engine overhaul up to, in the case of one, and far past in the case of the other two machines, the time limit for the engines prescribed by the makers. Chances of uncertain service, such as the above and the numerous other ways, need not be incurred, in the case of machines operating from a permanent base, with an almost certain gain in dependability.

As regards the efficiency of the aerial observer to spot fire, it is believed that this is entirely a question of personnel. Fires can be seen clearly and for great distances. They can be seen despite ground-haze, which from above is scarcely perceptible, and can be located by anyone provided with, and capable of reading, a good map. In addition to merely observing and locating fire, however, the aerial observer can also, and should be required, to report on its size and situation with respect to local fire barriers and progress during fighting—information which cannot be supplied by any other system of detection, except by great good fortune, and which is of immense value to the proper planning of fire fighting operations.

Suppression, which is at once the essential and most difficult part of any fire protection system, was successfully carried out by the use of air craft on two occasions. In one instance, this entailed the transportation and supplying of a total of six men for a distance of seventy-five miles by air; fire fighting was carried on for eight days. The second fire occurred forty miles from the base and was fought by four men taken in and supplied by air; for four days. Although opportunity for further work of this kind was abundant and could readily have been undertaken, it was considered inadvisable to do so in view of the fact that the unit was not organized for such work and that it would interfere too much with the regular survey work. The above results should indicate, however, that aerial transportation can be used for fire suppression.

The importance of aerial transportation, and the extent to which it could be used for forest fire suppression in this Province can only be grasped after a consideration of the large number of suitable ready-made landing grounds for sea-planes and flying boats which are scattered throughout almost the whole fire district; and the further consideration that successful development along this line would immediately place such points in the same category as road and railway heads, from which it would be possible to obtain men and supplies at short notice in case of any emergency.

9. *Summary.*—(a) Approximately 6,400,000 acres, lying in general between the G.T.P. Railway and the Albany - Lac Seul waterway, were mapped as composition types by sketch; about one-half of this was further classified into size classes.

Some 325,000 acres, in scattered strips, were covered by aerial photography.

Twenty-one special landings were made for sample plot work in typical forest stands.

Throughout the season forest fire detection was carried on, secondarily to

the survey work. Fighting was carried out in two instances, to explore the possibilities in this line.

(b) This survey was carried on in co-operation with the Canadian Air Board, who supplied three H.S.2L. flying boats with the necessary personnel and equipment; with R. N. Johnston of this Branch, and forestry student assistant F. T. Jenkins, as observers.

(c) The total flying time for the season was 333 hours; the cost, $140.00 per flying hour, and two-thirds cents per acre.

10. *Conclusions.*—It is believed that a proper attitude towards the following conclusions from the season's work is one which regards it as essentially experimental.

The H.S.2L. type of craft was serviceable because of the physiography of the region. A territory less liberally studded with lakes would require a machine of proportionately greater speed and climb. Some fitting-up is necessary for the working convenience and comfort of the observer.

The observer is called upon for rapid recognition and classification of types, according to recognized ground standards, and rapid mapping of boundaries. This requires special aptitude as training by flying is expensive.

Required ground studies should be done by separate crews.

Aerial photography is specialized work and should be attempted on a large scale only by units organized for that purpose. It requires, for best operation, flying equipment capable of high speed and climb, in order to take full advantage of good photographic light and to be able to operate at a height where aerial disturbances producing errors in exposure, are at a minimum. Cameras should be chosen with regard to the class of work required and the machine in which they are to be used. In survey work, the exposures should be finished and at least roughly plotted in the field, to prevent possible serious lack of data through some failure in field operations.

Fire detection can be carried on with either high or low performance machines, both reliably and efficiently. The matter of suppression is dependent for success on the opportunities for landing. These uses of the air craft being secondary, no estimate of cost can be given.

Operation cost of flying, being slight as compared to overhead, the season's program of work should make provision for the utilization of all possible flying time and not merely perfect flying weather.

In conclusion, it is desired to make reference to the splendid work of the personnel of the Air Board, and more particularly to the mechanics. No inference that their work was more worthy of mention than that of any other section of Air Board personnel is intended here, for this would be entirely untrue, but it is a fact that the work of the mechanic is usually overlooked. Nearly everyone is fully aware that a machine must have a pilot to fly, but how many have more than a dim realization of the absolute dependence of flight on the faithful, hard, and often unpleasant, work of the mechanic?

Of the hearty co-operation of the whole unit, however, enough cannot be said. Indeed, this was true to such an extent that work was carried on as if not two but one, and that a forest organization, was involved. This is the more remarkable when it is remembered that the foresters, through lack of data and experience, could not act with certainty from day to day, but had of neces-

sity to chop and change as experience and opportunity indicated. Such changes, discouraging in any case, must have been much more so when made, as they frequently were, for what, to an outsider, must have appeared as trivial or obscure reasons.

III. Reforestation.

Provincial Forestry Station, St. Williams:

The broadening-out policy, in preparation for the many reforestation projects which are facing the Government, has been emphasized during the year at St. Williams. A description of the work done is as follows:

Seed Beds.—Spring sowing of seed beds commenced April 5th and continued until June 9th. In all, 605 beds, each 30 feet long by 4 feet wide, were sown, the amount of seed used being 591¼ pounds of all species. Fall sowing of seed beds commenced November 15th and continued until December 10th. 340 beds of the same size were sown, requiring 395⅝ pounds of seed.

SPRING SOWING.

Species.	No. of Beds Sown.	Amount Seed per Bed. Ozs.	Total Amount Seed. Lbs.
White Pine	180	24	270
Scotch Pine	80	11	55
Jack Pine	75	12	56¼
Austrian Pine	5	28	8¾
White Spruce	180	12	135
Norway Spruce	5	20	6¼
White Cedar	80	12	60
Totals	605		591¼

FALL SOWING.

Species.	No. of Beds Sown.	Amount Seed per Bed. Ozs.	Total Amount Seed. Lbs.
White Pine	75	34	150
Scotch Pine	10	12	7½
Red Pine	210	12	157½
Jack Pine	5	10	3 1-8
White Spruce	35	24	52½
Basswood	5	5	25
Totals	340		395 5-8

Besides the sowing of these beds, the following hardwood species were sown in drills: Red Oak, 10 bushels; Black Walnut, 25 bushels; and Sweet Chestnut, 1½ bushels.

Nursery Lines.—During the spring 50,000 one-year-old jack pine seedlings were lined out; also a shipment of 40,000 white spruce and 60,000 Scotch pine, purchased from the Quebec Nursery. During the autumn, 1,000,000 Scotch

pine, which had been sown in the spring seed beds, were transplanted to the nursery lines.

Fertilizer.—In connection with the two foregoing operations, fertilizers, as shown hereafter, were used:

Location	Animal.		Mineral.		
	Manure.	Dried Blood.	Muriate of Potash.	Acid Phosphate.	Sulph. of Ammonia.
	Tons.	Lbs.	Lbs.	Lbs.	Lbs.
Lot 19	40	150		600	105
Lot 20	11				
Lot 22		370	60	310	62
Lot 4	6				
Lot 1	8	300	100	260	50

The following is a list of stock on hand December, 1920:—

Hardwoods:		
Ash, White	8,500	
Chestnut	4,000	
Cherry Bl.	1,450	
Hackberry	1,400	
Hicorz ovata	500	
Locust Bl.	2,900	
Maple, Man.	2,700	
Maple, Soft	6,300	
Oak, Red	20,900	
Poplar cuttings	250,000	
Walnut, Bl.	37,300	
Walnut Wh.	15,000	
		350,950
Conifers:		
Pine, Austrian	20,000	
Pine, Jack	2,134,000	
Pine, Scotch	2,349,500	
Pine, White	950,000	
Spruce, Norway	80,000	
Spruce White	2,728,000	
Cedar, White	505,000	
Balsam	8,000	
		8,774,500
Total of Hardwoods and Conifers		9,125 450

Additions to Property.—The most important addition to the station property was the installing of a new water system. This includes a pumping station capable of forcing 7,600 gallons of water per hour into a 20,000 gallon tank. This is elevated 100 feet from the ground, which gives excellent pressure to the system. 700 yards of 4-inch iron pipe form the main which, in turn, supplies the various nursery compartments through the existing 5 acres of overhead sprinkling system.

Four new buildings have been erected during the year. An implement house, 101 feet long by 30 feet wide, provides needed room for all machinery. One small barn, a common room for employees, and an additional workmen's house were also erected. This makes a total of 8 dwellings as follows: Manager's residence, foreman's house, 5 houses for teamsters, fire ranger, and workmen, and a common room.

Two and a half acres of new lawn was made, a half-mile cedar hedge planted, and 140 rods of wire fence was erected.

Several new roads were laid out on the property, necessitating the erection of two new bridges. Five miles of old road were cleared of brush, to facilitate fire-fighting work when needful. All fire roads were ploughed and cultivated, and an additional fire line of one-third of a mile in length was cleared and broken up.

Improvement Cutting.—On the 1,720 acres comprising the forest station, approximately seventy per cent. consists of woodland. During favorable weather in late fall and winter, improvement cutting was carried on, over an area of forty acres. Weed trees and windfalls were cut down, after which they were converted into logs and cordwood, the remaining slash being burned. Trees that showed evidence of butt rot, fire scar, ill form, oppression and senility were removed and utilized to the best advantage. The aim was to leave a stand composed of only sound, healthy, vigorous trees, thereby minimizing fire hazard and preventing, to a degree, insect and vegetable infection.

Protection (Disease and Insects).—Two men were employed during the summer months in connection with the eradication of Ribes for the prevention of the infection of nursery material with White Pine Blister Rust. No evidence of either Pine or Ribes stage of the disease was found. Destruction of White Pine Weevil was also carried on and all attacked leaders of trees in older plantations were removed, in an attempt to lessen the destruction caused by this insect.

Labor.—One of the difficulties in building up a permanent staff has been the lack of house accommodation, either on the Government property or elsewhere. With the increasing number of dwellings being erected at the station, this problem has been partially solved. For part time employment, which is a big factor in work of this kind, the neighborhood contributes plenty of young men. During the season, the personnel comprised, besides the manager of the station, a foreman, an under-foreman, 2 teamsters, a fire ranger, and 28 workmen.

Tree Planting.

Private Planting.—The work of tree distribution to private owners throughout the province was again carried on during the spring. The species available for distribution for the season of 1921 were as follows: Scotch pine, black walnut, butternut, red oak, white ash, sugar maple, white elm, and black locust.

Last year some fifty odd applications more than the branch could fill, were received. 225 separate operations were supplied. The number of trees for these amounted to 291,769 of all species. In terms of acres, this would represent, at six feet spacing, 240 acres of reforested land.

Government Planting.—Owing to the fact that the demand for planting material throughout the province was so great this year, little permanent planting was done at the forestry station at St. Williams. A mixture of Scotch pine and European larch was planted, covering an area of 5 acres, and 10,000 white spruce were planted in mixture with red oak.

A plantation of 3 acres was set out in Leeds county, with the co-operation of the council of Elizabethtown Township, where a sand ridge had been inconveniencing traffic on a county road for years. This plot will serve as a demonstration plantation for land owners in the neighborhood, who are threatened with drifting soil.

Extensive planting work was also carried on in connection with reclaiming the sand banks of Prince Edward County. These banks consist of a finger-

shaped peninsula which separates the waters of West Lake—a lake five miles in two dimensions—from Lake Ontario. The peninsula is three-quarters of a mile wide at its base and extends five miles in a north-westerly direction until it reaches the town of Wellington in a narrow point. From its orientation, it will be seen that part of the peninsula lies at right angles to the prevailing winds of Ontario. Because of this, much excellent land farm has for years been continually spoiled or covered up by drifting sand. Since this section of the country was first surveyed in 1852, it is estimated that 85 acres of good land have been covered with drifting soil.

The planting material used in this work consisted of Carolina poplar cuttings and green willow cuttings and limb material. Belts were planted one hundred feet apart, each belt consisting of one row of limb material and five to seven rows of cuttings, and were planted at right angles to the prevailing winds. The area planted would aggregate 150 acres and covers the part of the banks where the despoiling of agricultural land is most imminent.

Seed Collecting.

The Forestry Branch endeavors, as far as possible, to secure in the Province all seed used for the growing of nursery stock. The only exception, which is made in this regard, is Scotch pine seed. This tree, not being a native of America, the seed must necessarily be imported until trees of our own growing have become old enough to supply our needs. A quantity of Scotch and jack pine cones were gathered from the plantations at St. Williams; also 140 bushels of jack pine cones were gathered at a lumbering operation in Northern Ontario during the winter.

One of the most useful species for reforesting in Ontario is our native red pine. It grows well on poor soil, has few enemies, and is valuable for timber purposes. The only drawback in its use is the infrequency of its seed years. The season of 1921 was a good seed year for the species. The crop was not as general as the crop of 1913 was reported to have been, but groups of trees in the area covered, bore a maximum crop of cones.

The collecting of this species was confined to a section of Simcoe County, lying between Angus, Lisle and Tioga, which includes a large section of Camp Borden. Through the liberality of the Air Board in granting the use of a building for extracting purposes, and by co-operation in other ways, the work was carried on more expeditiously. It is doubtful whether a more suitable area than this for collecting red pine seed exists in the province. Here, the trees occur scattered in pure stands, and growing in this way, they have assumed the form of open grown trees which increases their value for seed collecting purposes.

The extracting of the seeds is carried on at the forestry station at St. Williams and also at Angus, where large quantities of seed have been gathered the last two years. Both plants handle the material which is gathered locally. The larger one is at Angus, and has a capacity of 20 bushels of red pine or 75 bushels of white spruce per 8-hour day. Two men do all the work, including firing, turning and filling the drums and cleaning of seed.

During this season, the crop of most hardwood seeds was poor. It was impossible to secure quantities of such useful trees as maple, white ash, and elm.

Seed collected during the year is as follows:

Species.	No. of Bushels.	Pounds of Seed.	Cost per Lb.
Red Pine	440	300	$6.74
Scotch Pine	95	56½	2.94
Jack Pine	175		4.45
Austrian Pine	3		
Black Locust	6	10½	4.11
Black Cherry	5-8		
Red Oak	13		2.25
Honey Locust		8	1.75
Sweet Chestnut	1½		
Walnut	25		
Soft Maple	1		

IV. Forest Pathology.

(Report of Dr. J. H. Faull for 1921).

Many interesting problems of forest pathology in Ontario have been called into review during the last year, some in continuation of uncompleted studies, others taken up in response to specific needs or inquiries. The field work was carried on mainly in the Temagami Forest Reserve, where, as in the past, valuable assistance was afforded by the Chief Ranger, Mr. C. E. Hindson. In addition, visits were made to the hardwood area of Algonquin Park, to the recently cut-over limits in the neighborhood of Otter, and to the pulpwood district north of Temiskaming. A few days were spent at the request of the Division of Forest Insects, Entomological Branch, Ottawa, in a co-operative examination of pulpwood forests injured by the spruce bud worm, to discover, if possible, what part fungi or other factors play in destroying the trees attacked by this pest. I was associated in my work, for a part of the time, with Mr. A. W. McCallum, B.Sc.F., Dominion Forest Pathologist, who was engaged in the study of a root rot of living trees, caused by the honey agaric, *Armillaria mellea*, an especially abundant form in our northern forests, and one which appears to be virulent in overcrowded stands or in trees much weakened by needle blight, spruce bud worm attacks, or other injuries, and with Mr. H. P. Bell, M.Sc., of Halifax, Nova Scotia, who was intimately concerned with certain diseases of balsam. As a part of the field work, extensive additions were made to our reference collections of pathological materials. These have likewise been considerably augmented by specimens sent in from various parts of Ontario, and from outside places, especially the contiguous provinces and states.

(1) Needle Blight of White Pine.

Observations for the fourth summer in succession, were made on the needle blight of the white pine, and the conclusions stated in the Reports of the Minister of Lands and Forests for 1919 and 1920 have been confirmed and extended. This malady, a yellowing or reddening in late spring or early summer, of the needles of the white pine, so prevalent in the Temagami Forest Reserve and to some extent in other parts of Ontario, is due to a killing of the absorbing

roots, ascribable to a drying-out that takes place in periods of drought in shallow or leachy soils. The result is that at the time the new needles are expanding, there is a sudden demand for water that cannot be supplied and, in consequence, the young needles turn pale and then redden from the tips downward. Owing to the dry weather experienced last summer (1921), the blight, while not as abundant as in 1918, was more sharply defined than in 1920. The forest commissioner for the State of Maine reports that a similar situation has prevailed in the pine forests on sandy soils in the southern part of Maine. But white pine (*Pinus Strobus*) is not the only tree affected in the blight areas, although it probably suffers much more severely than other types; proof is accumulating that shows that other timber species are involved to a greater or less extent, dependent on their relative susceptibilities. A full account will be published when the investigations in hand have been completed. The status of 633 white pine trees, whose history has been followed since 1918, is summarized in the table that follows:

Blighted trees studied	358
Checks (healthy trees)	275

Of the checks, two only have developed blight, and under known conditions. They blighted in 1919, following a partial lifting of the thin soil cover and its permanent displacement from the bed of coarse broken rock on which it lies—the action of ice. These trees died in 1921. The blighted trees have been divided into two classes: (1) those with trunks 6 inches or less in diameter (b.h.); (2) those with trunks more than 6 inches in diameter.

	Blighted in 1918.	Died 1919	Died 1920	Died 1921	Total % dead.	Showing blight in 1921.	Apparently recovered.	Doubtful.
I.	147	2	6	2	6.8	24	105	8
II.	211	12	20	18	23.7	80	44	37

From the results obtained, it is reasonable to conclude: (1) that young stands are not likely to be seriously depleted by needle blight; (2) that injury to heavily blighted mature stands may be so great as to be a deciding factor in determining the time of harvesting.

(2) Butt Rots.

Butt or stump rots constitute the outstanding destructive agencies at work in our Ontario forests. No type of forest is exempt, and every mature stand becomes more and more susceptible with increasing age. Butt rots, once established, continuously decrease stumpage values; they are also responsible for most windfalls, and so for the vast amounts of debris that litter the floors of our forests, affording a limitless supply of highly combustible wasted materials. There are various types, but all are due to the action of parasitic fungi. Fortunately, they are almost altogether restricted to mature or suppressed timber; young trees are practically immune. This fact greatly simplifies the problem of control. In this connection, it is in place to state that any effective plan of scientific forest management is bound to take cognizance of the part played by butt rots in the economics of the forest, and the administration of any such plan will not only secure a maximum yield from the forest, but will also make a long stride forward in the matter of fire control.

Our investigations on these trunk and root diseases have so far followed along three lines: (a) the tabulation of the various types as to kind, host relationship and distribution; (b) the working out of a ready means of field and laboratory diagnosis for each type; (c) consideration of particular cases in ressponse to special inquiries. To these, others should be added—such, for example, as the rate of progress of an infestation, and the relation of butt diseases to age, specific resistance and environmental factors. As a part of the scheme of tabulation, it would be especially profitable to include information relative to the age at which various species of trees lose their resistance to the inroads of the different kinds of decay fungi. Observations show that, in general, this feature will vary with location, and especially the characters of the physical and the biotic environment—such factors, for example, as soil, crowding, etc., and possibly climate. The factor of wounding or killing of roots is also important, for it is probable that none of the fungi concerned can gain entrance into the host except through wounds or dead areas in the bark and cambium. To what extent wounded and dead roots regularly occur in different localities remains to be seen. But from an examination of the root systems of many trees in the Temagami Forest Reserve, it is certain that in that region wounds are very common on the centrally directed faces of the main roots, particularly just below or near the trunk axis, and the inner roots are frequently dead.

(a) Much progress has been made in the work of tabulation. The fundamental need of this undertaking is indicated by the fact that several types of butt or heart rot have been found to be new. One of the most important of the latter, and recorded here for the first time, is a root and butt rot of spruce, hemlock, and white pine, with which a pored type of fungus, *Polyporus Tomentosus Fries*, is constantly associated. On further search, it will probably be found that the red and the jack pine should be included in this list, and possibly balsam. The fruiting body of the fungus is yellowish, leathery in texture, stalked, with a rounded cap 1-3 inches in diameter; it commonly grows on the soil in the neighborhood of coniferous trees, but is attached by its stalk to the covered roots of its host. The decay caused is of the piped or speckled type—whitish spots at first in the rather darkened wood, later becoming small cavities up to half an inch or more in length and a twelfth of an inch in diameter. This decay quite closely resembles the common "pecky wood-rot" or "partridge rot," caused by *Trametes pini*, but differs from the latter in that it is a butt rot. While not infrequent throughout it is apparently much commoner in some localities than in others. In the Otter district, for example, a high percentage of the white pine was affected, and to such an extent that frequently the butt log was of no value and was allowed to remain on the ground. I am indebted to Mr. A. W. McCallum for striking specimens of this decay as a heart rot in black spruce.

(b) One of the chief drawbacks encountered in investigating butt rots is the lack of information on the identity of the causal organisms. This applies to the larger number of butt and heart rots of conifers in America. Balsam rots may be cited as an extreme case, for though several types occur in living balsam trees, no one as yet, so far as the literature shows, has definitely established a connection with a specific fungus in any one case. To meet this need, and as an outgrowth of the present work, investigations in this field were independently inaugurated in the provincial University two years ago, and are now being vigorously carried forward with fruitful results. The methods employed are those so successfully used in cultural diagnostic studies of bacteria.

(c) A special case, calling for an investigation of heartwood weakened by fungi, was referred to the Forestry Branch by the manufacturers concerned, a year or so ago, in connection with the use of birch for spokes. A preliminary examination of our birch was soon after undertaken, and it has become evident that certain types of defective trees, easily recognizable, should be avoided as a source of wood calling for maximum resistance. The defects in question

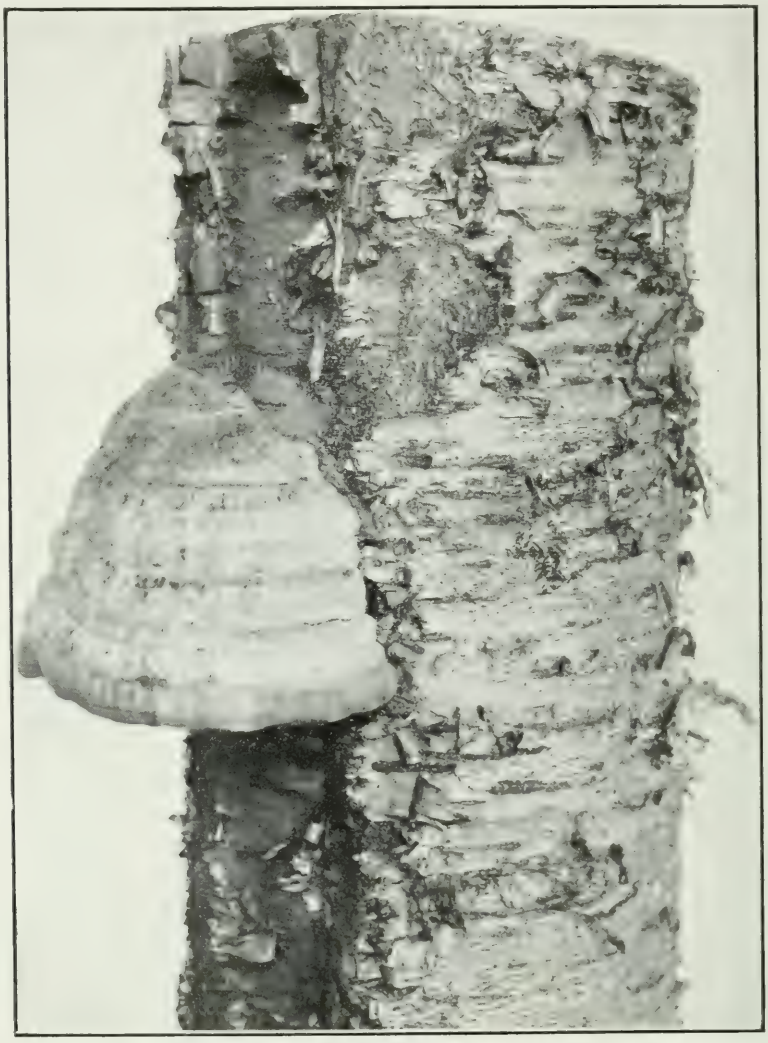


Fig. 1.— Fruit-body of the True Tinder Fungus on living Yellow Birch.

are ascribable to the true tinder fungus, one of the oldest known fungi, but like many others, imperfectly understood. A preliminary account follows.

(3) A Preliminary Account of the True Tinder Fungus.

The true tinder fungus attacks standing or fallen beech, birch, poplar, and occasionally elm, causing a whitish decay. It is readily recognized by its

fruiting-bodies or sporophores, the grayish hoof-shaped punks or brackets so common on the trunks of its hosts (Figure 1). Most frequently this fungus works from the crown down, though not invariably so. The true tinder fungus abounds throughout Ontario, and is also frequent in the adjoining states. Von Schrenk & Spaulding (Von Schrenk, H. & Perley Spaulding: Diseases of Decid-

Fig. 2.—Section of living Beech Tree showing Heart Rot caused by the True Tinder Fungus.

uous Forest Trees, Bull. No. 149, Bureau of Plant Industry, U.S. Dept. of Agr., Washington, 1909) report that "In northern New England, New York, Michigan, Wisconsin, and Minnesota in particular, the tinder fungus (*Fomes fomentarius*) is one of the commonest wood-destroying forms found in deciduous forests." The observations of the writer have been made for the main part in the Algonquin Park and the Lake Ontario areas.

Botanically, many new points of interest have been noted—such as the characters of its spores, their viability and method of germination, the remarkable habit of vernal spore discharge, and the production of spores for three or four years from the same pore layers. But the main interest here centers on

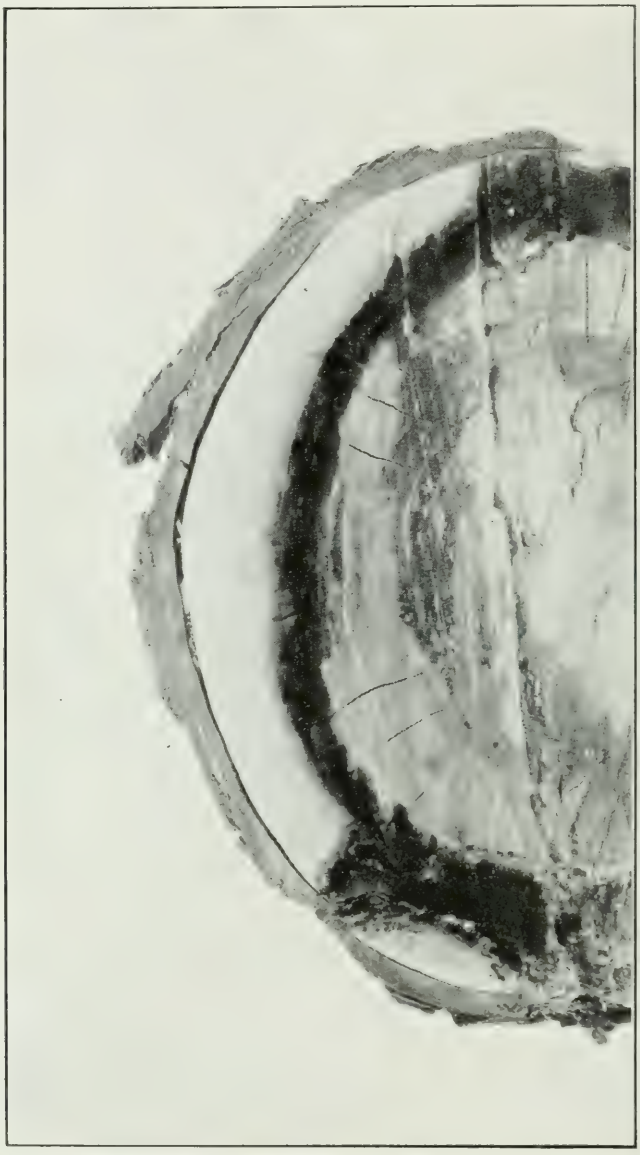
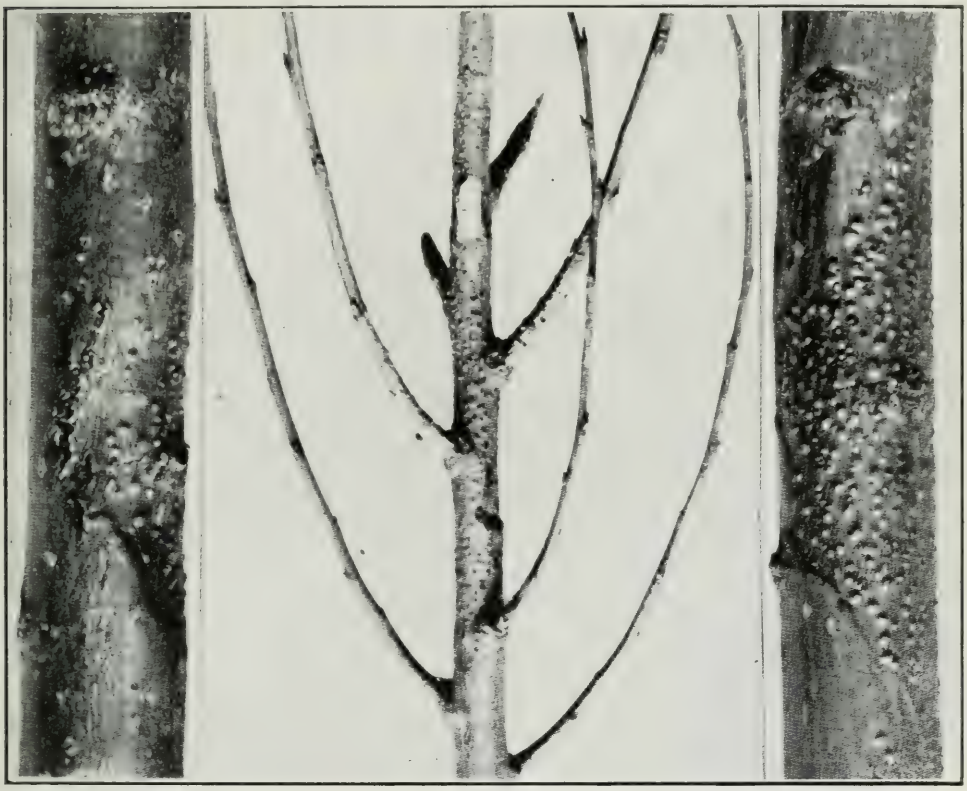


Fig. 3.—Section of Trunk of living Yellow Birch showing decay in inner sapwood and heartwood caused by the True Tinder Fungus. This section was kept for a few weeks under conditions favorable to development of fungus on the affected cut surface. The surface growth of the fungus darkened.

the relationship to its host. Regarding this feature, a general misconception has existed, and one that directly concerns the application of the heartwood to some industrial purposes. Various manuals or bulletins, dealing with the

fungus, ascribe to it a decay in the outer sapwood immediately under the bark, from there working inwards. An examination of hundreds of affected trees has failed to substantiate this view in any one instance. On the contrary, in living trees, the fungus enters through wounds or broken or dead branch stubs and penetrates to the inner sapwood and heartwood, rapidly spreading up and down in these regions of the stem and more slowly outward towards the bark. Figure 2 illustrates a section taken from a living beech in which this fungus is working as a pure heart rot. In birch it appears to spread more abundantly



Photographs by Hedgcock & Hunt.

Fig. 4.—Cankers in Lombardy Poplar caused by *Dothichiza populea.*

and rapidly in the inner sapwood as is shown in Figure 3, but it is important to note that the adjoining heartwood is also affected and, in consequence, weakened. One of the most significant features is the circumstance that cured timber from trees in which the decay is in its incipient stages, is indistinguishable by ordinary means of examination at the command of the user, from perfectly sound timber. The infection of the birch appears to be commonly associated with the breaking of the branches of the crown, due to the action of a boring insect. Complete results will be published when the investigations have been brought to a conclusion.

(4) A Poplar Canker.

Early in May, 1921, an examination was made for the Toronto Harbor Commission of a plantation of about 500 Lombardy poplars planted out in the fall of 1920 on the Lake Shore road, York County, which were found to be affected with a canker disease caused by an imported fungus, *Dothichiza populea*, Sacc. & Briard. Fully 80 per cent. of the trees were diseased, and all were cut down and destroyed. This fungus, apparently, found its way into America originally from Europe in nursery stock, and in the present instance there is every probability that the disease was already established in the young trees when they left the local nursery from which they were obtained. A visit to the nursery in question at the time, resulted in finding the disease in the remaining stock of Lombardy poplars. The causal fungus attacks the trunks and branches of trees of all ages, killing them outright or permanently disfiguring them; but it is especially virulent in newly transplanted trees and in stock heeled in for early spring planting. Besides the Lombardy poplar, it is also known to attack the cottonwood, *populus deltoides*. To what extent other poplars are susceptible is not known, but it seems worth while that this feature should be watched. It is also certain that there should be the closest inspection on the part of nurserymen and of those who purchase poplars from nurseries.

This disease was reported for the first time in America by Hedgcock & Hunt in 1916 (Hedgcock, George C. & N. R. Hunt: *Dothichiza populea* in the United States, Mycologia 8, pp. 300-308, 2 plates, 1916), but was known thirty years or more prior to that in Europe, especially in France, Germany and Italy. Specimens were received by the writer from an eastern source in Canada in 1917 through the courtesy of the Dominion Botanist. In Europe, *populus deltoides* seems quite as liable to attack as *populus nigra*, and in France severe losses have been experienced in plantations of the former grown for timber.

The causal fungus attacks the bark, killing the cambium. In such spots, the bark becomes more or less sunken, but not much discolored (Figure 4). These depressed areas or cankers rapidly extend in all directions, and as a result, girdling commonly takes place. Pustules soon appear on the cankers, and from them emerge countless numbers of tiny spores which serve to transmit the parasite to other hosts. Diseased trees in nurseries or in plantations should be cut down and burned.

I have the honour to be, sir,

your obedient servant,

E. J. ZAVITZ,

Provincial Forester.

Toronto, Ont., October 31st, A.D. 1921.

Appendix No. 49.

AGREEMENT BETWEEN PROVINCE AND E. W. BACKUS ET AL. REFERRED TO IN APPENDIX NO. 50.

THIS INDENTURE made in triplicate this thirtieth day of September, A.D. 1920.

BETWEEN:

His Majesty the King, represented by the Honourable the Minister of Lands and Forests for the Province of Ontario, hereinafter called the Crown,

OF THE FIRST PART,

—and —

Edward Wellington Backus, of the City of Minneapolis, in the State of Minnesota, Manufacturer, The Keewatin Lumber Company, Limited, and The Keewatin Power Company, Limited, hereinafter called the Company,

OF THE SECOND PART.

WHEREAS the Company did on the 7th day of July, A.D. 1920, enter into an Agreement with the Town of Kenora for the establishment of pulp and paper mills and saw mills in the town of Kenora, a copy of which Agreement is hereto attached, marked Schedule "A,"

AND WHEREAS the said Agreement has been ratified by the ratepayers of the said Municipality;

AND WHEREAS the Crown did by Agreement dated the 19th day of August, 1914, agree to sell to the Keewatin Lumber Company, Limited, the pulp wood on the area known as The Lake of the Woods Pulp Limit, a copy of which last-mentioned Agreement is hereto attached, marked Schedule "B";

AND WHEREAS the Keewatin Lumber Company, Limited, is in default under the terms of the said last-mentioned agreement and has now no rights thereunder;

AND WHEREAS there is not now, nor is there capable of development at Kenora, water power sufficient to produce electrical energy to operate a pulp mill of the capacity in the said Agreement, marked Schedule "B":

NOW THEREFORE THIS INDENTURE WITNESSETH that in consideration of the premises and of the mutual covenants, promises and agreements hereinafter contained, it is hereby agreed as follows:

1. The Crown hereby agrees that the said Agreement of the 19th day of August, 1914, between the Crown and the Keewatin Lumber Company, Limited, set out in Schedule "B" hereto, is now revived and is to be construed as in full force and effect from and after this date, save that paragraph 7 of the said Agreement, dated the 19th day of August, A.D. 1914, shall be and the same is hereby amended by striking out the figures "40" in the first line of said paragraph, and substituting the figures "80" and by striking out the figures "20" in the second line thereof and substituting the figures "40."

2. The Crown agrees to grant to the Company a lease of the water power known as the White Dog Rapids on the Winnipeg River in the District of Kenora, together with a strip of land on each side of the said rapids and all

the other land necessary for flowage purposes, together with all water power privileges and all rights, easements and appurtenances which the Minister of Lands and Forests may deem expedient for the utilization of the waters of White Dog Rapids for power purposes. For this purpose the Company shall submit plans and descriptions of survey of the necessary land required to be used in developing the said water power privilege and the construction of the necessary works thereon, such plans to be subject to the approval of the Minister of Lands and Forests, who, upon such approval, shall prepare a form of lease of the same in which the lands and lands under water to be covered by the lease will be specifically delimited. Upon the execution of said lease the Crown will grant to the Company the right to flood any Crown lands which the said Minister of Lands and Forests may deem expedient, and to such an extent and in such manner and subject to such conditions and stipulations as the Minister may deem expedient; all plans and specifications of works for the storage and regulation of said waters to be subject to the approval of the said Minister. The lease of the said water power will be the standard form of Government lease of water power, but in addition the said lease and right so granted shall be subject to the rights of all private owners of property who are liable to be affected by the development of the water power at the said Rapids or the storage of water in connection therewith, and to such rentals, reservations, provisoes, conditions and stipulations (including the regulation of the Norman dam at the outlet of the Lake of the Woods) as the Minister of Lands and Forests may deem to be in the public interests.

3. Neither said lease nor said right to flood Crown lands shall in any way be taken or construed as a demise or grant to the Company of any lands, or lands under water, rights or privileges not within the limits, power or legislative authority of the Province of Ontario, it being understood and agreed that the lands and lands covered by water to be therein demised or granted, and all rights or privileges to be thereby conferred, are limited to such as are owned or controlled by the Crown as hereinbefore defined.

4. It is hereby expressly provided and agreed that the Agreement for a lease to be given the Company as aforesaid is for the purpose of enabling the Company to carry out the terms of their said agreement with the Town of Kenora (Schedule "A") and their agreement with the Crown (Schedule "B") and is conditional upon the due performance of said agreements (save as otherwise herein provided) and upon the failure or neglect of the Company to carry out any of the terms of said agreements, or either of them, as herein provided, or of this agreement, the Minister of Lands and Forests for the Province of of Ontario, for the time being shall, in addition to all other powers contained in said lease, have the power to cancel the said lease and the agreement therefor herein contained.

5. In consideration whereof the Company agree that they will forthwith after the execution of this Agreement proceed with the erection in the Town of Kenora of the mills mentioned in paragraphs 1, 2 and 3 of said Agreement set out in Schedule "B" hereto, and in accordance with the provisions of the last-mentioned agreement will erect and complete the said mills mentioned in said paragraphs and will in all other respects carry out their obligations under the terms of the said Agreement as now revived, varied and amended, including the manufacture in the said mills of the wood from the area described in the said agreement (Schedule "B"), and specifically undertake that they will construct and place in operation one unit of the said pulp mill of 50 tons daily capacity, not later than the 1st day of October, 1921, and will continue con-

struction work uninterruptedly until the mills mentioned in the said Agreement (Schedule "B") shall be fully completed, subject to the direction of the Minister of Lands and Forests as to the erection of the paper mill.

6. And the Company hereby covenants and agrees to indemnify and save harmless the Crown against any and all causes of action, loss, costs, damages or expenses which may be awarded by lawful authority against the Crown in connection with, or by reason of, the development of said water power at White Dog Rapids.

7. The Company further agrees to reserve such quantities of news print paper as they may be required from time to time so to do by the Minister of Lands and Forests for the purchase by publishers within the Dominion of Canada.

8. The Crown will presently offer for public competition the pulpwood and timber on an area comprising a part of the English River Watershed and which area is bounded on the West by the boundary of the Province of Manitoba; on the South by the National Transcontinental Railway, on the North by the English River and Lac Seul, and on the East by the Westerly limit of Indian Reserve No. 28 extended north in a straight line to the northerly boundary and south to the southerly boundary of the said area; and the Company will tender for the said area in the terms of the conditions of sale thereof, one of which will be that the timber and pulpwood on the said area will be manufactured at Kenora (including the manufacture into newsprint paper of the pulpwood suitable for that purpose) and if the Company's tender is accepted the Company will enlarge their said mills at Kenora to at least the capacity mentioned in the said Agreement (Schedule "A") and will accept this Agreement as a satisfactory agreement within the meaning of clause (a) of paragraph 1 of the said Agreement (Schedule "A") and as a full compliance by the Town of Kenora with its obligations under clauses (ee) and (ff) of the said Agreement (Schedule "A" and the Company will thereupon carry out and perform all their obligations under the said agreement (Scheduel "A") and will further extend the said pulp and paper mills and increase the capacity thereof beyond that called for by the said Agreement (Schedule "A") as they may from time to time be required by the Minister of Lands and Forests to do, having regard to the quantity of pulpwood that will be available for the said mills. Provided that if it is ascertained by the Minister of Lands and Forests within three years from this date that there is not sufficient pulpwood and timber on the above described area to operate the said mills in Kenora as set forth in the said Agreement (Schedule "A") he will put up for public competition such an additional area or areas to the north of the English River as will provide the necessary timber and pulpwood for the said purpose, and in the Conditions of Sale thereof it shall be provided that the manufacture thereof shall be in the Town of Kenora. The ascertainment and estimate by the Minister as aforesaid shall be final and conclusive and binding on all parties to this Agreement.

9. Nothing in this agreement shall affect the application of the provisions of any statute or order-in-council whether now existing or which hereafter may be enacted or made dealing with the regulation, control or inspection of water power and of the use of waters in Ontario.

10. If the Company fails or neglects to erect, extend and operate the said mills in accordance with the terms of this Agreement, then all rights under this Agreement shall terminate and be forever forfeited. Provided, however, that there shall be no forfeiture or cancellation hereunder for the reason (if

that situation should arise) that the forest products available to the Company are found inadequate to carry on the operation of the said mills to the capacity mentioned in the said Agreement (Schedule "A").

11. Where the word "Company" occurs in this Agreement, it shall be understood to refer to and include the heirs, executors, administrators, successors and assigns of the parties hereto respectively of the Second Part, and this Agreement shall be binding upon all of the aforesaid parties.

IN WITNESS WHEREOF the Minister of Lands and Forests has hereunto set his hand and seal and the said Edward Wellington Backus has hereunto set his hand and seal and the Companies have affixed their corporate seals and the President of the said Companies has signed.

WITNESS:

F. J. NIVEN.

BENIAH BOWMAN,
Minister of Lands and Forests

EDWARD W. BACKUS,

[SEAL]
DEPARTMENT OF LANDS AND FORESTS.

THE KEEWATIN POWER COMPANY, LIMITED, by its President
EDWARD W. BACKUS.

[CORPORATE SEAL]
THE KEEWATIN LUMBER COMPANY, LIMITED.

THE KEEWATIN LUMBER COMPANY, LIMITED, by its President
EDWARD W. BACKUS.

Appendix No. 50.

THE ENGLISH RIVER PULPWOOD AND TIMBER LIMIT AGREEMENT.

THIS AGREEMENT made in triplicate this seventh day of January, One Thousand Nine Hundred and Twenty-one.

BETWEEN:

His Majesty, the King, represented by the Honourable, the Minister of Lands and Forests for the Province of Ontario, hereinafter called THE CROWN.

OF THE FIRST PART,

—and—

Edward Wellington Backus of the City of Minneapolis in the State of Minnesota, Manufacturer, The Keewatin Lumber Company, Limited, and the Keewatin Power Company, Limited, hereinafter called THE GRANTEES.

OF THE SECOND PART.

WHEREAS by advertisement, duly published, the Honourable, the Minister of Lands and Forests for the Province of Ontario, called for tenders to be received by him, up to and including the eighteenth day of December, 1920, for the right to cut forest products on an area in the English River watershed in the District of Kenora in the Province of Ontario, hereinafter more particularly described;

AND WHEREAS on the said eighteenth day of December, 1920, the said Minister received from the Grantees a tender for the right to cut the forest products on the said area, which said tender was duly accepted on the twenty-second day of December, 1920;

AND WHEREAS the grant of the right to cut forest products upon said area was, by said advertisement for tenders and by the tender of the said Grantees, based upon and subject to certain terms, conditions and stipulations;

AND WHEREAS this agreement is entered into for the purpose of ensuring the performance by the Grantees of the obligations contained in the said tender and acceptance thereof, as hereinafter defined, and of securing the Grantees the said supply of forest products for the purposes of the mill or mills to be established, maintained, conducted and carried on in the Town of Kenora in said District of Kenora;

AND WHEREAS under the terms of an agreement between the parties hereto dated the 30th day of September, A.D. 1920, and executed by the parties hereto, the said Grantees herein agreed to forthwith, after the execution of said agreement, dated the 30th day of September, A.D. 1920, proceed with the erection in the Town of Kenora, of certain mills therein referred to, and, upon certain other terms and conditions therein contained, to enlarge and further extend said mills and increase the capacity thereof as therein provided;

AND WHEREAS, in fulfilment of its promise therein contained to offer for competition certain pulpwood and timber on the area comprising a part of the English River Watershed, referred to in the 8th paragraph of said agreement, dated the 30th day of September, 1920, the Crown has offered for competition the forest products hereinafter more particularly described, and the Grantees have tendered for the said area, and the said Grantees' offer therefor has been accepted by the Crown, and the Grantees are now under obligation to carry out all their obligations to erect, construct, enlarge, extend, complete and operate the mills provided for in said agreement, dated the 30th day of September, 1920;

NOW THEREFORE, THIS INDENTURE WITNESSETH that in consideration of the premises and of the mutual covenants, promises and agreement hereinafter contained, it is hereby agreed as follows:

1. The Grantees shall proceed with the construction of the pulp and paper mills in said Town of Kenora provided for in said agreement, dated the 30th day of September, 1920, and on or before the 22nd day of October, 1921, shall have constructed and have in operation in the said Town of Kenora a pulp mill of a capacity of, and manufacturing, fifty (50) tons of pulp daily, and shall continue uninterruptedly the construction work upon said pulp and paper mills until there is being manufactured at said pulp and paper mills 200 tons of newsprint paper per day.

2. The Grantees shall fully complete and equip said pulp and paper mills and have the same in operation on or before the 22nd day of December, 1923, expending in said construction of said pulp and paper mills the sum of at least $2,500,000.00, of which sum of $2,500,000.00 so to be expended, the sum of not less than $1,000,000.00 shall have been expended by the Grantees, on or before the 22nd day of October, 1921.

3. Upon and after the said completion of said pulp and paper mills, the said Grantees, during the currency of this agreement, shall continue to operate the said pulp and paper mills so that the daily output thereof shall not be less than 200 tons of newsprint paper

4. The Grantees shall further extend the said pulp and paper mills and increase the capacity thereof as from time to time they may be required by the Minister so to do, having regard to the quantity of pulpwood available for the said mills.

5. The Grantees shall provide and operate a sawmill or sawmills in the said Town of Kenora of such capacity as the Minister from time to time may require, and shall operate the said sawmill or sawmills during the whole period of this agreement so that the output of said sawmill or sawmills, in each year thereof, shall be such reasonable quantities as from time to time may be required by said Minister.

6. The said Grantees shall employ and keep employed in connection with the operation of said pulp and paper and sawmills, at least 1,000 persons for at least 10 months in each and every year during the period of this agreement.

7. The said sawmills shall be in operation during the year 1921.

8. The Grantees shall further extend the said pulp and paper mills and increase the capacity thereof beyond that hereinbefore provided for, as they may from time to time be required by the Minister so to do, having regard to the quantities of pulpwood and other timber that will be available for the said mills.

9. In consideration of a cash bonus of $50,100 and of said expenditure, and of the contracts and agreements entered into on the part of the Grantees, the Crown will and doth for the dues hereinafter set forth and provided, and subject to the terms, conditions and regulations as to the locality and manner of cutting, measuring, removing and driving same as may from time to time be imposed by the Minister, and subject also as is hereinafter set forth and contained, grant to the Grantees the right to cut and remove all the merchantable timber or wood in or upon the area hereinafter described, to be used only in and for the purpose of supplying the said mill or mills to be erected, for a period of twenty-one years from the date hereof, from unoccupied, unsold and unlocated lands of the Crown as follows:

> Commencing at the intersection of the northerly limit of the Canadian National (Transcontinental) Railway right-of-way with the inter-provincial boundary between the provinces of Ontario and Manitoba; thence north along said inter-provincial boundary to the southerly shore of the English River; thence in a general course north-easterly, following the southerly shore in all its windings of said English River, lake expansions and Lac Seul to the intersection with the west limit of Indian Reserve No. 28; thence south-east and south, following the westerly and southerly boundaries of said Indian Reserve to the south-westerly angle thereof near Lost Lake; thence continuing south astronomically to the northerly limit of the aforesaid right-of-way; thence westerly, following the said limit right-of-way to the point of commencement, containing by admeasurement three thousand and forty-six square miles (3,046 sq. miles) more or less.
>
> Saving and excepting from the above-described area all Indian Reserves, all townsites, and all those parts of the Townships of Rice, Malachi, Redditt, Smellie, Redvers, Wabigoon, Buller, Wauchope, Ladysmith, and Rowell, lying north of said right-of-way, and all islands in lakes or rivers within the described area; also the rights of timber licensees as to timber sold on timber berths, A.T.W. 2, 3,

9, and 10, and timber sold on all other timber berths within the described area, under license.

Saving, excepting and reserving also therefrom all water powers; and also all lands heretofore patented, leased, located or applied for, in respect of which such proceedings have been taken or shall hereafter be taken as in the opinion of the Minister entitles the applicant or applicants to a lease or patent for such lands; together with the right of the Crown to sell, lease, locate or otherwise dispose of any water powers or lands included in the hereinbefore described area on such terms and conditions for settlement, mining or other purposes as the Minister may deem advisable.

10. The Grantees as to the right to cut the merchantable timber and wood on the said area as above described, shall pay a bonus of $50,100 (the receipt whereof is hereby acknowledged) and the following dues on said merchantable timber and wood: that is to say,

	Cents
Black Walnut and Oak, per cubic foot	.06
Elm, Ash, Tamarac and Maple, per cubic foot	.06
Birch, Basswood, Cedar, Poplar, per cubic foot	.05
Red and White Pine, and Jackpine, per cubic foot	.07½
All other woods, per cubic foot	.03
Basswood and Poplar sawlogs, per thousand feet B.M.	2.00
Pine sawlogs, per thousand feet B.M.	2.50
Maple and Oak sawlogs, per thousand feet B.M.	2.50
Hemlock, Tamarac, and other woods, per thousand feet B.M.	1.50
Spruce, per thousand feet B.M.	2.00
Cordwood (hard), per cord	.40
Cordwood (soft), per cord	.25
Tan Bark, per cord	.60
Spruce Pulpwood, per cord	.80
Balsam and other Pulpwood, per cord	.40
Railway Ties, per tie	.10
Spruce Boom Timber, per thousand feet B.M.	2.00
Pine Boom Timber, per thousand feet B.M.	2.50
All other Boom Timber, per thousand feet B.M.	2.50
Cedar Poles, 30 ft. and less	.25
Cedar Poles, 31 ft. to 40 ft.	.50
Cedar Poles, 41 ft. to 50 ft.	.75
Cedar Poles, 51 ft. and over	1.00
Cedar Posts, each	.02

or such other rates or dues thereon as may from time to time be fixed by the Lieutenant-Governor-in-Council; but in no case shall the price so to be fixed be at higher figures than the price at which the general public shall be permitted to cut on other portions of the Crown domain, or than others, similarly situated, shall be permitted to cut.

11. It is distinctly understood that the Grantees obtain the right to cut the timber only, and have no right to the soil or use thereof, except as may be necessary for cutting and removing the wood and timber, as aforesaid, subject to such reasonable terms, conditions and regulations as to the cutting, measuring, removing and driving of the same as may from time to time be imposed by the Minister.

12. The Grantees shall not have the right to cut or remove timber of any kind from any lands while under timber license or permit from the Crown.

13. The wood and timber shall be cut upon such portions of said territory, and in such manner as the Minister may from time to time direct, and such precautions shall be taken and means employed to prevent injury or destruction by fire on said territory as said Minister may require, including payment of such annual charge for fire protection as may from time to time be fixed by the Lieutenant-Governor-in-Council.

14. No wood or timber cut on the said territory shall be exported or sold to any person or persons; but such wood or timber shall be used for the purpose of supplying the mills of the said Grantees in the Town of Kenora as aforesaid.

15. The Grantees shall reserve such quantities of newsprint paper as they may be required from time to time so to do by the Minister, for purchase by publishers within the Dominion of Canada.

16. Proper sworn returns of the quantity of wood or timber cut each season shall be made by the Grantees to the Crown, in conformity with the Crown Timber Act and Regulations thereunder, and payment shall be made for such wood and timber not later than the 1st day of October in each year, and the Crown shall have all the rights and powers in respect of enforcing such payments as are now provided in the case of timber cut under timber license.

17. The Grantees shall not, at any time or in any place, deposit, empty, run or turn into any river, stream, or other waters whatsoever, any refuse, sawdust, chemicals, or matter of any kind, which shall or may be injurious to fish life, or have the effect of destroying, harming, or driving away the fish in such river, stream, or water.

18. All water powers and privileges on said territory, and the right of the Crown to raise, hold, lower, and maintain the waters on the rivers, streams and lakes in said territory at such height and in such conditions as may be found necessary and expedient for the development of such water powers, are reserved to the Crown.

19. The Crown shall retain the right to sell, lease, locate or otherwise dispose of any lands included in the said territory on the same terms and conditions for settlement, mining, or other purposes, as ordinary Crown lands situated elsewhere, and this agreement is not to impede or retard settlement, or mining operations, and nothing herein contained shall limit or affect the right of the Department of Lands and Forests to sell, lease, locate or otherwise dispose of lands in the aforesaid territory for settlement, mining or other purposes.

20. Nothing herein contained or to be done hereunder or by virtue hereof shall entitle the Grantees to a monopoly in the use of any rivers, streams, or lakes or tributaries thereof in the said territory, but the same shall be and continue open for the use of the public in accordance with the law in that behalf, and in the event of the works of the Grantees in any way interfering with the driving of logs or timber down the said rivers, streams, or lakes or tributaries thereof, the Minister shall have full power to determine from time to time the provisions necessary to overcome such interference and thereupon the said Grantees as and when directed will make provision accordingly.

21. It is distinctly understood and agreed that nothing herein contained shall, without the consent in writing of the Minister, be deemed to confer any

right to cut or remove timber from any territory or areas while under license or permit from the Crown.

22. The Minister shall have the right to have the timber operations on the said territory inspected at any time he may deem it advisable.

If upon any such inspection, it appears and the Minister so decides, that the timber operations are carried on in such a way that any merchantable or valuable timber which should be removed, is being left or destroyed, he shall have the right to have said timber estimated and charge the same to the Grantees, who shall pay for the same, as so estimated, at the same rates of dues as if it had been actually removed by the said Grantees.

23. The cutting and removing of the timber on this territory or any part thereof shall not be deemed to have been completed until it has been declared satisfactory by the Minister.

24. The Grantees, upon entering into this Agreement, shall deposit forthwith with the Provincial Treasurer of Ontario, Two Hundred and Fifty Thousand Dollars ($250,000.00) cash or an equal amount of Dominion of Canada bonds or Province of Ontario securities, to guarantee the erection and operation of the said mills in conformity with the said conditions, which said bonds and securities shall be forfeited to the Crown in the event of the failure of the Grantees to fulfill all or any of the conditions of this agreement. The said cash or bonds or securities shall be returned upon due performance of the conditions herein contained to the satisfaction of the Minister and the expenditure of the sums herein stipulated.

25. The Crown does not guarantee any particular quantity of wood or timber, nor undertake to do more than grant the right to cut such quantities of wood or timber as may be on the said area, subject to the reservations and conditions hereinbefore provided.

26. In the event of failure on the part of the Grantees to erect, construct, or operate the said pulp, paper or sawmills as hereinbefore agreed, or in default of the said Grantees keeping said pulp, paper and sawmills in operation after the erection thereof, or keeping the required number of persons employed as aforesaid, or upon default of compliance with any of the terms, requirements, provisions or conditions as aforesaid, the Crown may revoke the right, license or permit to cut the said forest products, and upon said revocation all rights of the Grantees under this agreement shall be and become *ipso facto* null and void, and all securities or moneys paid as a deposit or bonus herein shall be forfeited to the Crown as liquidated damages; provided that thirty days' notice in writing of intention to revoke the said right, license or permit shall be given by registered letter addressed to the Grantees at the said Town of Kenora, before any such revocation, in order that the Grantees may have an opportunity of being heard should either or any of them so desire.

27. The word "Minister" herein shall mean Minister of Lands and Forests for the Province of Ontario.

28. This agreement shall be binding upon and enure to the benefit of the Grantees, their heirs, executors, administrators, successors, and assigns. Provided, however, that this agreement and the term hereby created, shall not be assigned or transferred without the written consent of the Minister.

29. The said parties for themselves, their heirs, successors, executors, administrators, and assigns, respectively, do hereby respectively covenant and agree to the full performance on their part, respectively, of everything herein stipulated to be done.

IN WITNESS WHEREOF the said Minister of Lands and Forests for the Province of Ontario and the parties hereto of the second part, have hereunto set their hands and seals.

SIGNED, SEALED AND DELIVERED
in the presence of
(Sgd.) F. J. NIVEN.

(Sgd.) BENIAH BOWMAN.

As to the execution by the Minister of Lands and Forests
(Sgd.) F. J. NIVEN.

(Sgd.) EDWARD WELLINGTON BACKUS.

As to the execution by Edward Wellington Backus, The Keewatin Lumber Company, Ltd., and the Keewatin Power Company, Ltd.
(Sgd.) F. J. NIVEN.

(Sgd.) KEEWATIN LUMBER COMPANY, LTD., by E. W. Backus, Pres.

(Sgd.) KEEWATIN POWER COMPANY, LTD., by E. W. Backus, Pres.

Attest:
(Sgd.) CHAS. C. NONEY,
Secretary, Keewatin Lumber Co., Ltd.

Attest:
(Sgd.) CHAS. C. NONEY,
Secretary, Keewatin Power Co., Ltd.

Appendix No. 51.

NIPIGON PULP AND PINE LIMIT AGREEMENT.

THIS AGREEMENT made in triplicate this 15th day of July, One Thousand Nine Hundred and Twenty-one.

BETWEEN:

His Majesty, the King, represented by the Honourable, the Minister of Lands and Forests for the Province of Ontario, hereinafter called THE CROWN,

OF THE FIRST PART,

—and—

Provincial Paper Mills, Limited, hereinafter called THE GRANTEE,

OF THE SECOND PART.

WHEREAS, by advertisement duly published, the Honourable, the Minister of Lands and Forests for Ontario, called for tenders to be received by him up to and including the 29th day of December, 1920, for the right to cut pulpwood and pine timber on a certain area situated on the north side of Lake Superior, and territory adjacent thereto, in the District of Thunder Bay, hereinafter more particularly described,

AND WHEREAS on the 29th day of December, 1920, the said Minister received from the Grantee a tender for the right to cut pulpwood and pine timber on said area, which said tender has been approved and accepted,

AND WHEREAS the grant of the right to cut pulpwood and pine timber upon said area was, by said advertisement for tenders and by the tender of the said Grantee, based upon and subject to certain terms, conditions and stipulations,

AND WHEREAS this agreement is entered into for the purpose of ensuring the performance by the Grantee of the obligations contained in the said tender and acceptance thereof as hereinafter defined and of securing the Grantee the said supply of pulpwood and pine timber for the purpose of the mill or mills to be established, maintained, conducted, and carried on at a point or points within the District of Thunder Bay or some place approved by the Lieutenant-Governor-in-Council,

NOW THEREFORE, THIS INDENTURE WITNESSETH that, in consideration of the premises, it is agreed by and between the Grantee and the Crown as follows:

1. The Grantee shall, on or before two years from the date hereof, have in operation at a point or points within the District of Thunder Bay, or at the Grantee's option at some other place, approved by the Lieutenant-Governor-in-Council, a paper mill or mills with the necessary pulp mills therewith of a value of not less than $1,500,000.00, and have in operation at some point or points as aforesaid, within one year of the date of acceptance of tender, a mill or mills of the value of not less than $1,000,000.00; and upon and after the completion of said mills, the said Grantee, during the currency of this agreement, shall, subject as hereinafter provided, continue to operate the said mills, and shall employ and keep employed, in connection with the operation of said mills, at least 300 persons on an average for at least ten months in each and every year during the currency of this agreement.

2. Commencing with the month of January, 1925, the Grantee shall, in the month of January of each and every year during the currency of this agreement, deliver to the Minister upon such form as the Minister may direct, a statement, verified by the oath of the secretary of the Grantee, showing the persons, who, during the calendar year ending with the thirty-first day of December then next preceding, were employed by the Grantee in operating the said mills, together with such other details in connection therewith as the Minister may require.

3. The Grantee shall manufacture at said mill or mills a quality of paper equivalent to that now in use in the publication of school-books by the Department of Education of the Province of Ontario, as may from time to time be directed by the Lieutenant-Governor-in-Council, and shall supply directly or indirectly during the period covered by this agreement, such quantity of said grade of paper as shall, in the opinion of the Minister of Lands and Forests, fully satisfy the requirements of the said Department of Education at prices to be agreed on, or in default of agreement at the then market price or prices, which said market price or prices is or are to be ascertained and determined by arbitration as follows: The same shall be referred and submitted to the arbitration, determination and award of three arbitrators, one arbitrator to be nominated by the Minister, one arbitrator to be nominated by the Grantee, and the third by the two so named, or in default of those two agreeing on the third, such third arbitrator to be appointed by any judge of the Supreme Court of

Ontario. The award of such arbitrators (or any two of them) shall be final and conclusive, and there shall be no appeal therefrom and the parties hereto do mutually covenant and agree each with the other that the award to be made by the said arbitrators or any two of them, shall in all respects be well and faithfully kept and observed. The provisions of "The Arbitration Act" of Ontario, save so far as the same may be inconsistent with the provisions hereof, shall apply to said arbitration; it being understood that delivieries shall be made promptly, notwithstanding that the price may not have been agreed upon or ascertained or determined.

4. As and when required so to do by a publisher or publishers of the Province of Ontario, the Grantee shall supply to such publisher or publishers, at prices to be agreed upon by the Grantee and such publisher or publishers, paper of the quality specified in Clause 3 hereof, but so that not more than fifteen per centum of the output of said mills shall be required to be supplied under the terms of this Clause.

5. In consideration of the bonus hereinafter mentioned and of said expenditures and of the contracts and agreements entered into on the part of the Grantee, the Crown, for the said bonus and the dues hereinafter set forth and provided and subject to the terms, conditions, and regulations as to locality and manner of cutting, measuring, driving and removing same as may from time to time be imposed by the Minister and subject also as hereinafter set forth and contained, will and doth grant to the Grantee the right to cut and remove all spruce, balsam, banksian or jackpine, poplar and whitewood trees, to supply for a period of twenty-one years the said mill or mills or extensions thereof or additions thereto (provided however, that where such extensions or additions are outside the District of Thunder Bay, the same have been approved of by the Lieutenant-Governor-in-Council); and also to cut and remove all red and white pine trees from unlicensed, unoccupied, unsold and unlocated lands of the Crown in or upon the area hereinafter described as follows:

> Commencing at the point in which the east limit of the Township of Nipigon intersects the north shore of Nipigon Bay of Lake Superior; thence north along the east boundary of the said township 5 miles and 36½ chains to the north-east angle of the township; thence east astronomically a distance of 5 miles and 30 chains more or less to a point south, astronomically, from the south-east angle of the Township of Ledger; thence north, astronomically, seven (7) miles, more or less to the south-east angle of the said Township of Ledger; thence east, astronomically, along the south boundary of the Nipigon Forest Reserve twenty-two (22) miles to the south-east angle thereof; thence north, astronomically, along the east boundary of the Nipigon Forest Reserve eight (8) miles; thence east, astronomically, a distance of twenty-eight (28) miles, more or less, to a point of intersection with the west boundary of the Pic River Pulp and Timber Limit produced north; thence south eight (8) miles, more or less, to the north-west angle of said Pic River Pulp and Timber Limit and continuing south along the west boundary of said timber limit twenty-three (23) miles, more or less, to the north shore of Lake Superior; thence westerly and north-westerly, following the shore of Lake Superior to the place of beginning, containing an area of one thousand two hundred and forty (1,240) square miles, more or less, excepting from the above described area, the right-of-way and lands of the Canadian Pacific Railway Company, and all other lands patented, leased or sold therein.

Reserving and excepting, nevertheless, from the above-described area, all lands under the water of all rivers, lakes and streams within the said described area; also all lands heretofore patented, licensed, located or applied for in respect of which such proceedings have been taken or shall hereafter be taken as in the opinion of the Minister entitles the applicant or applicants to a lease or patent for such lands, together with the right of the Crown to sell, lease, locate or otherwise dispose of any lands included in the hereinbefore described area on the same terms and conditions for settlement, mining or other purposes as ordinary Crown lands situated elsewhere.

6. The Grantee, as to the right to cut the pulpwood and pine timber on said area, as above described, shall pay a bonus of $1.33 per cord for spruce pulpwood; a bonus of 20 cents per cord for all other pulpwood above mentioned; and a bonus of $5.00 per thousand feet, board measure, for pine logs, and shall also pay the following Crown dues, namely: 80 cents per cord for spruce pulpwood; 40 cents per cord for all other pulpwood; $2.50 per thousand feet, board measure, for pine logs; or such other dues as shall be fixed from time to time by the Lieutenant-Governor-in-Council.

7. It is distinctly understood that the Grantee obtains the right to cut the timber only, and has no right to the soil or use thereof, except as may be necessary for cutting and removing the wood and timber, as aforesaid, subject to such terms, conditions and regulations as to the cutting, measuring, removing and driving of the same, as may from time to time be imposed by the Minister.

8. The wood and timber shall be cut upon such portions of said territory, and in such manner as the Minister may from time to time direct, and such precautions shall be taken and means employed to prevent injury or destruction by fire on said territory as said Minister may require, including payment of such annual charge for fire protection as may from time to time be fixed by the Lieutenant-Governor-in-Council.

9. All pulpwood cut on the said territory shall be used for the supply of, and shall be manufactured at the said mills or extensions thereof or additions thereto (provided, however, that where such extensions or additions are outside the District of Thunder Bay, the same shall have been approved of by the Lieutenant-Governor-in-Council). All pine timber shall be sold subject to the manufacturing condition, that is to say, it shall be manufactured in the Dominion of Canada.

10. The Crown does not guarantee any particular quantity of wood or timber nor undertake to do more than grant the right to cut such quantities of wood or timber as may be on said area, subject to the reservations and conditions hereinbefore provided.

11. Proper sworn returns of wood and timber cut each season shall be made by the Grantee to the Crown, in conformity with the Crown Timber Act and regulations thereunder, and payment of bonus and Crown dues upon all the wood and timber cut by the Grantee, shall be made by the Grantee to the Crown forthwith upon the rendering from time to time by the Crown to the Grantee of an account thereof; and in addition to all other remedies it may have therefor, the Crown shall have all the rights and powers in respect of the enforcement of such payments and of any interest charges thereon as are now or hereafter may be provided in the case of the dues on timber cut under timber license.

12. The Minister shall have the right to inspect the timber operations on the said territory at any time he may deem it advisable or in the public interest; and if upon inspection it appears, and the Minister so decides, that the said timber operations are carried on in such a way that any merchantable or valuable timber that should be removed, is being left or destroyed, the Minister shall have the right to estimate the said timber so remaining uncut or being destroyed, and charge the same to the Grantee at, and the Grantee shall pay therefor, the same rate of dues and bonus as if the same had been actually removed by the said Grantee.

13. The cutting and removing of timber on said territory or any part thereof shall not be deemed to have been completed until it has been examined by an officer of the Crown nor until such operation shall have been declared satisfactory by the Minister.

14. The Grantee shall not, at any time or in any place, deposit, empty, run or turn into any river, stream, or other waters whatsoever, any refuse, sawdust, chemicals, or matter of any kind, which shall or may be injurious to fish life, or have the effect of destroying, harming or driving away the fish in such river, stream or water.

15. All water powers and privileges on said territory, and the right of the Crown to raise, hold, lower, and maintain the waters on the rivers, streams and lakes in said territory at such height and in such conditions as may be found necessary and expedient for the development of such water powers, are reserved to the Crown.

16. The Crown shall retain the right to sell, lease, locate or otherwise dispose of any lands included in the said territory on the same terms and conditions for settlement, mining, or other purposes as ordinary Crown lands situated elsewhere, and this agreement is not to impede or retard settlement, or mining operations, and nothing herein contained shall limit or affect the right of the Crown or its Ministers to sell, lease, locate or otherwise dispose of lands in the aforesaid territory for settlement, mining or other purposes.

17. Nothing herein contained or to be done hereunder or by virtue hereof, shall entitle the Grantee to a monopoly in the use of any rivers, streams, or lakes or tributaries thereof, in the said territory, but the same shall be and continue open for the use of the public in accordance with the law in that behalf, and in the event of the works of the Grantee in any way interfering with the driving of logs or timber down the said rivers, streams or lakes or tributaries thereof, the Minister, as well as such other lawful authority as may be constituted therefor, shall have full power to determine from time to time the provisions necessary to overcome such interference, and thereupon the said Grantee, as and when directed, will make provision accordingly.

18. It is distinctly understood and agreed that nothing herein contained shall be deemed to confer any right to cut or remove timber from any territory or area while under license or permit from the Crown.

19. The deposit of $25,000.00, made by the Grantee with its said tender, shall be held by the Crown as security for due performance by the Grantee of its agreements contained in Clause 1 hereof, to have in operation as therein mentioned, within one year from the date of said tender, a mill or mills of the value of not less than $1,000,000 and to have in operation as in said Clause 1 hereof mentioned, within two years from the date hereof, a mill or mills with the necessary pulp mills therewith, of the value of not less than $1,500,000, and upon the Grantee complying to the satisfaction of the Minister, with the said provisions

of said Clause 1 hereof, the said $25,000.00 shall be applied by the Crown and go in reduction of the first moneys payable by the Grantee for dues and bonuses hereunder, until in that way the Grantee has been given credit for the full sum of $25,000.00.

20. Subject to the power of the Minister to waive the right of revocation, caused by any failure on the part of the Grantee, herein provided for, in the event of failure on the part of the Grantee to erect, construct, or operate the said pulp or paper mills as herein agreed, or in default of the said Grantee keeping said pulp or paper mills in operation after the erection thereof as herein agreed, or keeping the required number of persons employed as herein agreed, or upon default of compliance with any other of the terms, requirements, provisions or conditions as aforesaid, the Crown may revoke the right, license, or permit to cut the said forest products, and upon said revocation all rights of the Grantee under this agreement shall be and become *ipso facto* null and void, and all moneys paid as a deposit or bonus herein, shall be forfeited to the Crown, provided that thirty days' notice in writing of intention to revoke the said right, license, or permit shall be given by registered letter addressed to the Grantee at 54 University Avenue, Toronto, Ontario, before any such revocation, in order that the Grantee may have an opportunity of being heard should it so desire.

21. Upon all bonus and dues of all kinds on the pulpwood and timber cut under this agreement prior to the first day of May in any year during the currency of this agreement remaining unpaid on the thirtieth day of September next ensuing thereafter the Grantee, without prejudice to the power of the Crown to enforce the payment of such bonus and dues at any time the Minister may think proper, shall pay to the Crown, interest at the rate of six per cent. per annum from said thirtieth day of September; and upon all of such bonus and dues remaining unpaid on the thirty-first day of October then next ensuing, the Grantee shall pay interest at the rate of one per cent. (1%) per month from said thirty-first day of October until the same is fully paid.

22. The word "Minister" shall mean Minister of Lands and Forests for the Province of Ontario.

23. This agreement shall be binding upon and enure to the benefit of the Grantee, its successors and assigns; provided, however, that this agreement and the term created shall not be assigned or transferred without the written consent of the Minister, endorsed on said assignment or transfer.

24. The said parties, for themselves, their heirs and assigns, respectively, do hereby covenant and agree to the full performance on their part, respectively, of everything herein stipulated to be done.

IN WITNESS WHEREOF said Minister of Lands and Forests for the Province of Ontario, and the Grantee, have hereunto set their hands and seals.

SIGNED, SEALED AND DELIVERED in the presence of

Witness as to execution by the Honourable, the Minister of Lands and Forests.
W. C. Cain.

Witness as to execution by Provincial Paper Mills, Limited.
Margaret Craine.

Beniah Bowman.

Provincial Paper Mills, Limited, by J. H. Weldon, President.

By S. F. Duncan, Secretary.

Appendix No. 52.

THE NAGAGAMI RIVER PULP AND TIMBER LIMIT AGREEMENT.

THIS AGREEMENT made in triplicate this fifteenth day of September, One Thousand Nine Hundred and Twenty-one.

BETWEEN:

His Majesty, the King, represented by the Honourable, the Minister of Lands and Forests for the Province of Ontario, hereinafter called THE CROWN.

OF THE FIRST PART,

—and—

The Transcontinental Development Company, Limited, hereinafter called THE GRANTEE,

OF THE SECOND PART.

WHEREAS, by advertisement duly published, the Honourable, the Minister of Lands and Forests for Ontario, called for tenders to be received by him up to and including the fifteenth day of June, 1921, for the right to cut pulpwood and pine timber on a certain area situated on the Nagagami River and other territory adjacent thereto in the District of Algoma, hereinafter more particularly described,

AND WHEREAS on the fifteenth day of June, 1921, the said Minister received from the Grantee the tender for the right to cut pulpwood and pine timber on said area, which said tender has been approved and accepted,

AND WHEREAS the right to cut pulpwood and pine timber on said area was, by said advertisement for tenders and by the tender of the said Grantee, based upon and subject to certain terms, conditions and stipulations,

AND WHEREAS this agreement is entered into for the purpose of ensuring the performance by the Grantee of the obligations contained in said tender and acceptance thereof as hereinafter defined, and of securing the Grantee the said supply of pulpwood and pine timber for the purpose of the mill or mills to be established, maintained, conducted and carried on at a point or points at or near the said area at some place or places approved of by the Minister,

NOW THEREFORE, THIS INDENTURE WITNESSETH that in consideration of the premises it is agreed by and between the Grantee and the Crown as follows:

1. On or before the third day of October, 1921, the Grantee shall have commenced construction work on a pulp mill within the limits of the territory hereinafter described, or at some place in the Province of Ontario approved by the Minister and will throughly equip the same so that the expenditure in connection with the erection, equipment and machinery of the said pulp mill will be at least One Million Dollars ($1,000,000), and shall expend in connection with the erection, equipment and machinery of the said pulp mill as follows: On or before the fifteenth day of June, 1922, the sum of Two Hundred Thousand Dollars ($200,000); between the fifteenth day of June, 1922, and the fifteenth day of June, 1923, the latter day inclusive, the sum of Three Hundred and Fifty

Thousand Dollars ($350,000); and between the fifteenth day of June, 1923, and the fifteenth day of June, 1924, the sum of Four Hundred and Fifty Thousand Dollars ($450,000).

2. Upon and after the completion of said pulp mill, the said Grantee, during the currency of this agreement, shall continue to operate the said pulp mill so that the daily output thereof shall, in each and every day during the currency of this agreement, be not less than 100 tons of pulp; and shall employ or keep employed, in connection with said operation of said mill, at least two hundred (200) persons on an average for at least 10 months in each and every year during the period of this agreement, and the employment of hands as aforesaid shall form part of the consideration for the price of the pulpwood and pine timber.

Commencing with the month of January, 1925, the Grantee shall, in the month of January of each and every year during the currency of this agreement, deliver to the Minister, upon such form as the Minister may direct, a statement verified by the oath of the secretary of the Grantee, showing the persons who, during the calendar year ending with the 31st day of December then next preceding, were employed by the Grantee in operating said mill, together with such other details in connection therewith as the Minister may require.

3. The Grantee shall erect a paper mill within such time and at such place as the Minister of Lands and Forests may direct, having a capacity of at least seventy-five (75) tons of paper per day; and after the erection thereof shall operate the same continuously for the period of this agreement, so that the daily output of the said mill shall not be less than fifty (50) tons of paper. The Grantee hereby agrees to reserve from time to time such quantities of newsprint paper as it may be required to do by the said Minister for the purchase by publishers within the Dominion of Canada.

4. The cutting of the said pulpwood and timber may begin as soon as, but not before, the said sum of Two Hundred Thousand Dollars ($200,000) shall have been expended on the erection, equipment and machinery of said mills, buildings and structures.

5. In consideration of the bonus hereinafter mentioned and of the said expenditure and of the contracts and agreements entered into on the part of the Grantee, for the said bonus and the dues hereinafter set forth and provided and subject to the terms, conditions and regulations as to locality and manner of cutting, measuring, driving and removing the same as may from time to time be imposed by the Minister, and subject also as hereinafter set forth and contained, the Crown will and doth grant to the Grantee the right to cut and remove all the spruce, balsam, banksian or jack pine, poplar and whitewood trees sufficient to supply the said mill or mills to be erected, for a period of twenty-one (21) years, and also to remove all red and white pine trees from unlicensed, unoccupied, unsold and unlocated lands of the Crown in or upon the area hereinafter described as follows:

> Commencing at the south-west angle of the township of Foch, thence north along the line between the districts of Algoma and Thunder Bay a distance of 54 miles, 1 chain and 26 links, to the north-west angle of the township of Boyce; thence east along the north boundaries of the townships of Boyce, Shuel, Mulloy, Fintry and Auden, a distance of 46 miles, 58 chains and 50 links, to the north-east angle of the last named township; thence south along the east boundaries of the township of Auden and Gill, 18 miles to the south-east angle of the township

of Gill; thence west along the south boundary of Gill 9 miles, 4 chains and 63 links to the south-west angle of the township; thence south along the west boundaries of Storey, Langemarck and Dowsley 26 miles, 77 chains and 58 links to the south-west angle of Dowsley; thence east along the south boundary of that township 9 miles, 1 chain and 65 links to the south-east angle thereof, thence south astronomically along the east limit of Farquhar township 9 miles and 6 chains, more or less, to the south-east angle of the township; thence west along the south boundaries of Farquhar, Haig, Wicksteed, Lessard and Foch 47 miles, 44 chains and 70 links, more or less, to the place of beginning.

Reserving and excepting nevertheless from the above-described area the right-of-way of the Canadian National Railway through the townships of Farquhar, Haig, Wicksteed, Lessard, Nagagami and Flanders, and also the right of way through the townships of Gill, McMillan, Fintry, Mulloy and Shuel, also all lands under the water of all rivers, lakes and streams within the said described area; also all lands heretofore patented, licensed, leased, located or applied for in respect of which such proceedings have been taken or shall hereafter be taken as in the opinion of the Minister of Lands and Forests entitles the applicant or applicants to a lease or patent for such lands, together with the right of the Crown to sell, lease, locate or otherwise dispose of any lands included in the hereinbefore described area on the same terms and conditions for settlement, mining or other purposes as ordinary Crown lands situated elsewhere.

6. The Grantee, as to the right to cut the pulpwood and pine timber on said area as above described, shall pay a bonus of thirty-five cents (35c) per cord for spruce pulpwood in addition to the Crown dues of eighty cents (80c) per cord and shall pay a bonus of thirty-five cents (35c) per cord for all other pulpwood above mentioned in addition to Crown dues of forty cents (40c) per cord, and shall pay a bonus of ten dollars ($10) per thousand feet board measure for pine logs in addition to dues of two dollars and fifty cents ($2.50) per thousand feet board measure, or such other rates of dues as may from time to time be fixed by the Lieutenant-Governor-in-Council for such pulpwood and pine timber.

7. It is distinctly understood that the Grantee obtains the right to cut the timber only and has no right to the soil or use thereof except as may be necessary for cutting and removing the wood and timber as aforesaid, subject to such terms, conditions and regulations as to the cutting, measuring, removing and driving of the same as may from time to time be imposed by the Minister.

8. The wood and timber shall be cut upon such portions of said territory and in such manner as the Minister may from time to time direct and such precautions shall be taken and means employed to prevent injury or destruction by fire on said territory as said Minister may require, including payment of such annual charge for fire protection as may from time to time be fixed by the Lieuenant-Governor-in-Council.

9. All pulpwood cut on the said territory shall be used for the supply of, and shall be manufactured at the said mills (or extensions thereof or additions thereto approved by the Minister). All pine timber shall be sold subject to the manufacturing condition, that is to say, it shall be manufactured in the Dominion of Canada.

10. The Crown does not guarantee any particular quantity of wood or timber nor undertake to more than grant the right to cut such quantities of wood or timber of the kind aforesaid as may be on the said area, subject to the reservations and conditions hereinbefore provided.

11. Proper sworn returns of wood and timber cut each season shall be made by the Grantee to the Crown in conformity with the Crown Timber Act and regulations thereunder, and payment of bonus and Crown dues upon all wood and timber cut by the Grantee shall be made by the Grantee to the Crown forthwith upon the rendering from time to time by the Crown to the Grantee of an account thereof, and in addition to all other remedies it may have therefor, the Crown shall have all the rights and powers in respect of the enforcement of such payments and of any interest charges thereon as are now or hereafter may be provided in the case of the dues on timber cut under timber license.

12. Upon all bonus and dues of all kinds on the pulpwood and timber cut under this agreement prior to the first day of May in any year during the currency of this agreement remaining unpaid on the thirtieth day of September next ensuing thereafter, the Grantee, without prejudice to the power of the Crown to enforce the payment of such bonus and dues at any time the Minister may think proper, shall pay to the Crown interest at the rate of six per cent. (6%) per annum from said thirtieth day of September, and upon all of such bonus and dues remaining unpaid on the thirty-first day of October then next ensuing, the Grantee shall pay interest at the rate of one per cent. (1%) per month from said thirty-first day of October until the same is fully paid.

13. The Minister shall have the right to inspect the timber operations on the said territory at any time he may deem it advisable or in the public interest, and if upon such inspection it appears to the Minister and the Minister so decides that the said timber operations are carried on in such a way that any merchantable or valuable timber that should be removed is being left or destroyed the said Minister shall have the right to estimate the timber so remaining uncut or being destroyed and the Grantee shall pay therefor the same rates of dues and bonus as if the same had been actually removed by the said Grantee.

14. The cutting and removing of timber on the said area or any part thereof shall not be deemed to have been completed until it has been examined by an officer of the Crown nor until such operation shall have been declared satisfactory by the said Minister.

15. The Grantee shall not at any time or at any place, deposit, empty, run or turn into any river, stream, or other waters whatsoever, any refuse, sawdust, chemicals or matter of any kind which shall or may be injurious to the fish life or have the effect of destroying, harming, or driving away the fish in such river, stream or water.

16. All water powers and privileges on said territory and the right of the Crown to raise, hold, lower, and maintain the waters on the rivers, streams, and lakes in said territory at such height and in such conditions as may be found necessary and expedient for the development of such water powers, are reserved to the Crown.

17. The Crown shall retain the right to sell, lease, locate or otherwise dispose of any lands included in the said area on the same terms and conditions for settlement, mining or other purposes as ordinary Crown lands situated elsewhere, and this agreement is not to impede or retard settlement or mining operations, and nothing herein contained shall limit or affect the right of the Crown or its Ministers to sell, lease, locate or otherwise dispose of lands in the aforesaid territory for settlement, mining or other purposes.

18. Nothing herein contained or to be done hereunder or by virtue hereof shall entitle the Grantee to a monopoly of any rivers, streams or lakes or tributaries thereof in the said territory, but the same shall be and continue open for the use of the public in accordance with the law in that behalf and in the event of the works of the Grantee in any way interfering with the driving of logs or timber down the said rivers, streams or lakes or tributaries thereof, the Minister shall have full power to determine from time to time the provisions necessary to overcome such an interference, and thereupon the said Grantee as and when directed shall make provision accordingly.

19. It is distinctly understood and agreed that nothing herein contained shall without the consent in writing of the Minister be deemed to confer any right to cut or remove any timber from any area while under license or permit from the Crown.

20. The deposit of $50,000 made by the Grantee with the said tender shall be held by the Crown as security for the due performance by the Grantee of the provisions contained in clause numbered 1 hereof. After the said pulp mill is erected and in operation, the said deposit of $50,000 may be applied on account of the payment of bonus as it from time to time accrues, and, subject to said application to the payment of bonus, said deposit shall remain as a guarantee for the due performance by the Grantee of all the obligations of the Grantee under this agreement. Said deposit shall be forfeited to the Crown in the event of the failure of the Grantee to fulfil all or any of the obligations or conditions of this agreement. The said deposit, or so much, if any, thereof as shall not have been applied to the payment of bonus, shall be returned to the Grantee upon due performance to the satisfaction of the Minister, of the obligations and conditions herein contained.

21. In the event of failure on the part of the Grantee to erect, construct or operate the said pulp and paper mills as hereinbefore agreed, or in default of the said Grantee keeping said pulp and paper mills in operation after the erection thereof or keeping the required number of persons employed as aforesaid, or upon default of compliance with any of the terms, requirements, provisions or conditions as aforesaid, the Crown may revoke the right, license or permit to cut the said forest products, and upon said revocation all rights of the Grantee under this agreement shall be and become ipso facto null and void and all securities or moneys paid as deposit or bonus herein shall be forfeited to the Crown as liquidated damages, providing that thirty (30) days' notice in writing of intention to revoke the said right, license or permit shall be given, which said notice may be given by registered letter addressed to the Grantee at its head office in Ontario, before any such revocation, in order that the Grantee may have an opportunity of being heard, should it so desire.

22. The Minister shall have the power to extend, within the said period of twenty-one years, the time for the doing by the Grantee of any act required by this agreement to be done by the Grantee, and also shall have the power to waive the right of revocation caused by any failure on the part of the Grantee herein provided for.

23. The Grantee may negotiate with the Crown for the purpose of enabling the Grantee to secure an undeveloped water power to develop for the operation of the mill or mills hereinbefore mentioned.

24. The word "Minister" shall mean Minister of Lands and Forests for the Province of Ontario.

25. This Agreement shall be binding upon and enure to the benefit of the Grantee, its successors and assigns, provided, however, that this agreement and the term created shall not be assigned or transferred without the written consent of the Minister.

26. The said parties, for themselves, their successors and assigns, respectively do hereby covenant and agree to the full performance on their part respectively, of everything herein stipulated to be done.

IN WITNESS WHEREOF, said Minister of Lands and Forests for the Province of Ontario and the Grantee, have hereunto set their hands and seals.

Signed, Sealed, and Delivered in the Presence of:

W. C. CAIN.

E. PEARLE KING.

BENIAH BOWMAN,
Minister of Lands and Forests.

TRANSCONTINENTAL DEVELOPMENT COMPANY, LIMITED.

W. S. MORLOCK, *President.*

SAMUEL D. FOWLER, *Secretary.*

Appendix No. 53.

THE LONG LAKE PULP AND TIMBER LIMIT AGREEMENT.

THIS AGREEMENT made in triplicate this fourth day of August, One Thousand, Nine Hundred and Twenty-one,

BETWEEN:

His Majesty the King, represented by the Honourable the Minister of Lands and Forests of the Province of Ontario, hereinafter called "THE CROWN,"

OF THE FIRST PART,

—and—

John Homer Black, of the City of Toronto, in the County of York and Province of Ontario, hereinafter called "THE GRANTEE,"

OF THE SECOND PART.

WHEREAS by advertisement duly published, the Honourable the Minister of Lands and Forests for Ontario, called for tenders to be received by him up to and including the fourth day of July, 1921, for the right to cut pulpwood and pine timber on a certain area situated in the vicinity of Long Lake, in the District of Thunder Bay, hereinafter more particularly described,

AND WHEREAS on the fourth day of July, 1921, the said Minister received from the Grantee the tender for the right to cut pulpwood and pine timber on said area, which said tender has been approved and accepted,

AND WHEREAS the right to cut pulpwood and pine timber on said area was by said advertisement for tenders and by the tender of the said Grantee based upon and subject to certain terms, conditions and stipulations,

AND WHEREAS this agreement is entered into for the purpose of ensuring the performance by the Grantee of the obligations contained in said tender and acceptance thereof as hereinafter defined, and of securing the Grantee

the said supply of pulpwood and pine timber for the purpose of the mill or mills to be established, maintained, conducted and carried on at a point or points at or near the said area at some place or places approved of by the Minister,

NOW, THEREFORE, THIS INDENTURE WITNESSETH that in consideration of the premises, it is agreed by and between the Grantee and the Crown as follows:

1. On or before the twelfth day of October, 1921, the Grantee shall have commenced construction work on a pulp mill in or near said area at some place approved by the Lieutenant-Governor-in-Council and will thoroughly equip the same so that the expenditure in connection with the erection, equipment and machinery of said pulp mill will be at least one million dollars ($1,000,000), and shall expend in connection with the erection, equipment and machinery of said pulp mill as follows: On or before the fourth day of July, 1922, the sum of two hundred thousand dollars ($200,000); between the fourth day of July, 1922, and the fourth day of July, 1923, the latter day inclusive, the sum of three hundred and fifty thousand dollars ($350,000), and between the fourth day of July, 1923, and the fourth day of July, 1924, the sum of four hundred and fifty thousand dollars ($450,000), on or before which last-mentioned date the Grantee shall have said mill equipped and in operation.

2. Upon and after the completion of said mill, said Grantee, during the currency of this agreement, shall continue to operate the said pulp mill so that the daily output thereof shall, in each and every day during the currency of this agreement, be not less than one hundred and fifty (150) tons of pulp, and shall employ or keep employed in connection with said operation of said mill at least three hundred (300) persons on an average for at least ten (10) months in each and every year during the period of this agreement, and the employment of said three hundred (300) persons as aforesaid shall form part of the consideration for the price of the pulpwood and pine timber.

Commencing with the month of January, 1925, the Grantee shall, in the month of January of each and every year during the currency of this agreement, deliver to the Minister upon such form as the Minister may direct, a statement, verified by the oath of the secretary of the Grantee, showing the persons who, during the calendar year ending with the thirty-first day of December then next preceding, were employed by the Grantee in operating the said mill, together with such other details in connection therewith as the Minister may require.

3. The Grantee shall with all convenient despatch proceed to construct a paper mill or mills in or near the said area at such place as the Minister may direct, which said paper mill or mills shall be of the capacity of at least one hundred (100) tons of paper per day and shall have the same in operation on or before the fourth day of July, 1925, and on and after the completion of said paper mill or mills, the said Grantee during the currency of this agreement shall continue to operate said mill or mills continuously so that the daily output thereof shall not be less than 75 tons of paper. The Grantee hereby agrees to reserve from time to time, such quantities of newsprint paper as he may be required to do by the Minister for purchase by publishers within the Dominion of Canada.

4. The cutting of the said pulpwood and timber may begin as soon as but not before the said sum of two hundred thousand dollars ($200,000) shall have been expended on the erection, equipment and machinery of said mills, buildings and structures.

5. In consideration of the bonus hereinafter mentioned, and of the said expenditure and of the contracts and agreements entered into on the part of the Grantee, for the said bonus and the dues hereinafter set forth and provided, and subject to the terms, conditions and regulations as to locality and manner of cutting, measuring, driving and removing the same as may from time to time be imposed by the Minister, and subject also as hereinafter set forth and contained; the Crown will and doth grant to the Grantee the right to cut and remove all the spruce, balsam, banksian or jack pine, poplar and whitewood trees sufficient to supply the said mill or mills to be erected for a period of twenty-one (21) years from the date hereof, and also to remove all red and white pine trees from unlicensed, unoccupied, unsold and unlocated lands of the Crown in or upon the area hereinafter described, as follows:

Commencing at a point in the north boundary of the Nipigon Pulp and Timber Limit at the distance of 12 miles east from the east boundary of the Nipigon Forest Reserve; thence north astronomically 68 miles, more or less, to the southerly limit of the right-of-way of the Canadian National Railway (National Transcontinental), thence easterly along the southerly limit of the said right-of-way 66 miles, more or less, to the north boundary of the township of Barlow; thence continuing easterly along the said limit of said right-of-way through the townships of Barlow, Selwyn and Henderson 25 9 10 miles, more or less, to the east boundary of the last named township; thence south along the east boundaries of the townships of Henderson and Bell, 13 miles more or less, to the south-east angle of Bell; thence west along the south boundaries of the townships of Bell, Low, Klotz, Fernow and O'Meara, 45 miles more or less, to the south-west angle of O'Meara, thence south astronomically 24 miles; thence west astronomically 16 miles; thence south astronomically 16 miles more or less, to the easterly prolongation of the north boundary of the Nipigon Pulp and Timber Limit; thence west astronomically allong the said line 30 miles, more or less, to the place of beginning.

Reserving and excepting therefrom the right of way of the Canadian National Railway (Canadian Northern) and also all Indian Reserves, and all lands under the water of all rivers, lakes and streams within the said described area; also all lands heretofore patented, licensed, leased, located or applied for in respect of which such proceedings have been taken or shall hereafter be taken as in the opinion of the Minister of Lands and Forests entitled the applicant or applicants to a lease or patent for such lands, together with the right of the Crown to sell, lease, locate or otherwise dispose of any lands included in the hereinbefore described area on the same terms and conditions for settlement, mining or other purposes as ordinary Crown lands situated elsewhere.

6. The Grantee as to the right to cut the pulpwood and pine timber on said area as above described shall pay a bonus of forty-nine cents (49c) per cord for spruce pulpwood in addition to the Crown dues of eighty cents (80c) per cord and shall pay a bonus of thirty-eight cents (38c) per cord for all other pulpwood above mentioned, in addition to Crown dues of forty cents (40c) per cord, and shall pay a bonus of ten dollars ($10) per thousand feet, board measure for pine logs in addition to dues of two dollars and fifty cents ($2.50) per thousand feet, board measure, or such other rates of dues as may from time

to time be fixed by the Lieutenant-Governor-in-Council for such pulpwood and pine timber.

7. It is distinctly understood that the Grantee obtains the right to cut the timber only and has no right to the soil or use thereof except as may be necessary for cutting and removing the wood and timber as aforesaid, subject to such terms, conditions and regulations as to the cutting, measuring, removing and driving of the same as may from time to time be imposed by the Minister.

8. The wood and timber shall be cut upon such portions of said territory and in such manner as the Minister may from time to time direct and such precautions shall be taken and means employed to prevent injury or destruction by fire on said territory as said Minister may require, including payment of such annual charge for fire protection as from time to time may be fixed by the Lieutenant-Governor-in-Council.

9. All pulpwood cut on the said territory shall be used for the supply of, and shall be manufactured at the said mills (or extensions thereof or additions thereto approved of by the Lieutenant-Governor-in-Council). All pine timber shall be sold subject to the manufacturing condition, that is to say, it shall be manufactured in the Dominion of Canada.

10. The Crown does not guarantee any particular quantity of wood or timber nor undertake to do more than grant the right to cut such quantities of wood or timber of the kind aforesaid as may be on the said area, subject to the reservations and conditions hereinbefore provided.

11. Proper sworn returns of wood and timber cut each season shall be made by the Grantee to the Crown in conformity with the Crown Timber Act and regulations thereunder, and payment of bonus and Crown dues upon all the wood and timber cut by the Grantee shall be made by the Grantee to the Crown forthwith upon the rendering from time to time by the Crown to the Grantee of an account thereof, and in addition to all other remedies it may have therefor, the Crown shall have all the rights and powers in respect of the enforcement of such payments and of any interest charges thereon as are now or hereafter may be provided in the case of the dues on timber cut under timber license.

12. Upon all bonus and dues of all kinds on the pulpwood and timber cut under this agreement prior to the first day of May in any year during the currency of this agreement remaining unpaid on the thirtieth day of September next ensuing thereafter, the Grantee, without prejudice to the power of the Crown to enforce the payment of such bonus and dues at any time the Minister may think proper, shall pay to the Crown interest at the rate of six per cent. (6%) per annum from said thirtieth day of September, and upon all of such bonus and dues remaining unpaid on the thirty-first day of October then next ensuing, the Grantee shall pay interest at the rate of one per cent. (1%) per month from said thirty-first day of October until the same is fully paid.

13. The Minister shall have the right to inspect the timber operations on the said territory at any time he may deem it advisable or in the public interest, and if upon such inspection it appears to the Minister and the Minister so decides that the said timber operations are carried on in such a way that any merchantable or valuable timber that should be removed is being left or destroyed, the said Minister shall have the right to estimate the timber so remaining uncut or being destroyed and the Grantee shall pay therefor the same rates of dues and bonus as if the same had been actually removed by the said Grantee

14. The cutting and removing of timber in the said area or any part thereof shall not be deemed to have been completed until it has been examined by an officer of the Crown, nor until such operation shall have been declared satisfactory by the said Minister.

15. The Grantee shall not at any time or at any place deposit, empty, run or turn into any river, stream, or other waters whatsoever, any refuse, sawdust, chemicals or matter of any kind which shall or may be injurious to fish life or have the effect of destroying, harming, or driving away the fish in such river, stream or water.

16. All water powers and privileges on said territory and the right of the Crown to raise, hold, lower and maintain the waters on the rivers, streams and lakes in said territory at such height and in such conditions as may be found necessary and expedient for the development of such water power, are reserved to the Crown.

17. The Crown shall retain the right to sell, lease, locate or otherwise dispose of any lands included in the said area on the same terms and conditions for settlement, mining or other purposes as ordinary Crown lands situated elsewhere, and this agreement is not to impede or retard settlement or mining operations, and nothing herein contained shall limit or affect the right of the Crown or its Ministers to sell, lease, locate or otherwise dispose of lands in the aforesaid territory for settlement, mining or other purposes.

18. Nothing herein contained or to be done hereunder or by virtue hereof, shall entitle the Grantee to a monopoly of any rivers, streams or lakes, or tributaries thereof in the said territory, but the same shall be and continue open for the use of the public in accordance with the law in that behalf, and in the event of the works of the Grantee in any way interfering with the driving of logs or timber down the said rivers, streams, or lakes, or tributaries thereof, the Minister shall have full power to determine from time to time the provisions necessary to overcome such an interference, and thereupon the said Grantee as and when directed shall make provision accordingly.

19. It is distinctly understood and agreed that nothing herein contained shall, without the consent in writing of the Minister, be deemed to confer any right to cut or remove any timber from any area while under license or permit from the Crown.

20. The sum of fifty thousand dollars ($50,000) deposited by the Grantee with its tender for the above area shall remain on deposit to guarantee the due performance by the Grantee of all the obligations of the Grantee under this agreement, which said deposit shall be forfeited to the Crown in the event of the failure of the Grantee to fulfil all or any of the obligations or conditions of this agreement. The said deposit shall be returned upon due performance of the obligations and conditions herein contained to the satisfaction of the Minister.

21. In the event of failure on the part of the Grantee to erect, construct or operate the said pulp or paper mills as herein agreed or in default of the said Grantee keeping said pulp or paper mills in operation after the erection thereof as herein agreed, or keeping the required number of persons employed as herein agreed, or upon default of compliance with any other of the terms, requirements provisions, or conditions as aforesaid, the Crown may revoke the right, license or permit to cut the said forest products, and upon said revocation all rights of the Grantee under this agreement shall be and become ipso facto null and void, and all moneys paid as a deposit, or bonus herein, shall be forfeited to the Crown, provided that thirty days' notice in writing of intention to revoke the said right

license or permit shall be given by registered letter addressed to the Grantee at the City of Toronto, in the County of York, before any such revocation, in order that the Grantee may have an opportunity of being heard should it so desire.

22. The word "Minister" shall mean Minister of Lands and Forests for the Province of Ontario.

23. This agreement shall be binding upon and enure to the benefit of the Grantee, its successors and assigns, provided, however, that this agreement and the term created shall not be assigned or transferred without the written consent of the Minister.

24. The said parties, for themselves, their heirs and assigns, respectively do hereby covenant and agree to the full performance on their part respectively, of everything herein stipulated to be done.

25. IN WITNESS WHEREOF, said Minister of Lands and Forests for the Province of Ontario, and the Grantee, have hereunto set their hands and seals.

Signed, Sealed and Delivered in the presence of

(Signed) W. C. CAIN.

(Signed) BENIAH BOWMAN,
Minister of Lands and Forests.

(Signed) J. H. BLACK.

PROVINCE OF ONTARIO
DEPARTMENT OF MINES

HON. H. MILLS, MINISTER OF MINES — THOS. W. GIBSON, DEPUTY MINISTER

THIRTIETH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

VOL. XXX, PART 1, 1921

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PRINTED BY ORDER OF THE LEGISLATIVE ASSEMBLY OF ONTARIO

TORONTO :
Printed by CLARKSON W. JAMES, Printer to the King's Most Excellent Majesty
1922

Printed by
THE RYERSON PRESS

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LETTER OF TRANSMISSION

To His Honour, Lionel Herbert Clarke,

Lieutenant-Governor of the Province of Ontario.

Sir,—I have the honour to transmit to you herewith, for presentation to the Legislative Assembly of the Province of Ontario, the Thirtieth Annual Report of the Department of Mines.

I have the honour to be, Sir,

Your obedient servant,

Henry Mills,

Minister of Mines.

Department of Mines,
Toronto, 1921.

INTRODUCTORY LETTER

To the Honourable H. Mills,

Minister of Mines.

Sir,—I beg to lay before you herewith, the Thirtieth Report of the Department of Mines, being for the year 1920. The Report is published in seven parts, not only for convenience in handling and reference, but also for the sake of economy in printing. By this method the Department is enabled, when desirable, to publish a monograph dealing with a single field or a single subject without waiting for other matter, and also to vary the size of the edition according to the interest of the material and the probable demand for the report. Papers by different authors on adjacent areas or on like topics can also with advantage be grouped. The contents of the Thirtieth Report and the arrangement of the Parts numbering from one to seven, with the names of authors, are shown on the following page.

From time to time, as important discoveries are made and fresh mineral belts opened up, public interest naturally shifts from one metal or mineral to another. Thirty years ago, when the great resources of nickel and copper in the Sudbury area were beginning to be recognized and exploited, the demand was for information regarding the geology of the nickel-copper ranges and the relationships which the ore deposits bore to the enclosing rocks.

A little later, when gold was found widely scattered on the shores of Lake of the Woods, Seine river and Manitou lake, and when hopes were entertained, not yet realized, of establishing there important centres of gold production, the public looked to the Department for similar information regarding the gold occurrences of these areas.

So, likewise, when the phenomenal riches of the Cobalt silver field were revealed; and subsequently, when Porcupine began to assert its wonderful wealth of gold. To Porcupine has succeeded Kirkland Lake, whose rank as a gold producer next to Porcupine is now assured. Kirkland Lake is being followed by numerous other localities where gold in apparently important quantity has been found.

It now seems certain that the silver age of Ontario, in which Cobalt and its subsidiary camps caught and held the attention of the world, is to be followed by an age of gold, and that Northern Ontario will make really substantial contributions to the world's production of that metal. Naturally, the Department must put itself in a position to meet, as far as possible, the demand for information which such a programme of development inspires. Its permanent staff of geologists and other skilled men from the universities and elsewhere, year by year are sent to spend the open season in the wilds, and the results of their observations are printed in the reports and maps issued by the Department, which are distributed without charge. Not only is attention given to known mineral belts or areas, but the Department strives as much as possible to examine and depict the geology of previously unprospected and unmapped areas, whose situation and relationships are such as to encourage hope of their containing mineral wealth.

Ample evidence is afforded that these efforts of the Department are fully appreciated, both by investors and prospectors, and that the data thus obtained are used with good results by the latter in their labours. It is conceived that the function of the Department is not to attempt the discovery of actual deposits of minerals, but to facilitate their discovery by studying the conditions under which they exist, and the rocks or contacts most favourable for their occurrence, and by making the results available in easily understood form.

I regret that considerable delay has taken place in bringing out the full Report, especially Parts 1 and 7. This has been very largely due to the unfortunate printers' strike which began June 1st, 1921, and which prevented a single galley of proof being delivered at the Department for six months. Printing was then resumed, but on a reduced scale, and the work was attended with many difficulties. Indeed, the strike is still nominally in force, but it is expected that the Department's report for 1921 will soon begin to be placed, part by part, in your hands.

I have the honour to be, Sir,

Your obedient servant,

Thos. W. Gibson,

Deputy Minister of Mines.

Department of Mines,

Toronto, 1921.

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STATISTICAL REVIEW

OF

ONTARIO'S MINERAL INDUSTRY IN 1920

By W. R. Rogers

Economic transition conditions from a war to a peace basis that characterized the year 1919 continued through 1920, with the result that the mineral industry of Ontario remained more less unsettled. An endeavour to maintain the high scale of prices and wages in most lines which had increased by gradual steps during the war period was in opposition to existing world conditions and a natural tendency to return to pre-war levels. The adverse exchange situation experienced by former belligerent countries in Europe permitted them to market their goods at much lower prices than was possible on the American continent, United States and Canadian commodity prices being thus forced down. This movement was not felt until the latter part of the year. If the process is gradual, heavy loss and bankruptcy will be avoided.

The deflation period in Canada, an expected war aftermath following the signing of the armistice, took nearly two years to arrive. Artificial methods of maintaining high prices finally proved ineffectual and lower levels prevailed, more particularly during the two closing months of the year. However, it is not the purpose of this review to analyze changes in economic conditions except in so far as they have a bearing on Ontario's mineral industry.

Just as labour was becoming more plentiful in the fall of the year the operation of gold and silver mines in Northern Ontario was handicapped by a shortage of hydro-electric power, precluding the possibility of utilizing the increase in man power. This power shortage, due to scanty precipitation during the late summer and fall, continued until the spring of 1921. At Porcupine the Hollinger gold mine rushed in several train loads of coal for use in its auxiliary steam plant. At Kirkland Lake the new 150-ton mill of the Wright-Hargreaves gold mine was ready for operation but could not start up for lack of power until spring. In the Cobalt camp the power shortage was acute for some weeks and this condition accentuated the difficulty of profitable operation resulting from a sharp decline in the price of silver.

Speaking generally the year was marked by high prices, which stimulated production despite high operating costs. Quantity production, therefore, as compared with previous years provides a more accurate criterion of the state of the mining industry than a basis of valuation. Details regarding output and conditions in the several phases of the mining industry are noted under separate headings. The value of metalliferous production exceeded that of any pre-war year, while the non-metallic valuation was the greatest in Ontario's history.

Table I, which follows, gives a summary of Ontario's mineral production in 1920, together with the number of employees and wages paid to workmen by operators.

TABLE I.—SUMMARY OF MINERAL STATISTICS OF ONTARIO FOR 1920

Product	Quantity	Value	Employees	Wages
		$		$
METALLIC.				
Gold ounces	565,283	11,686,043	1,986	3,113,084
Silver "	11,065,415	10,873,496	1,951	2,659,201
Copper in matte (a) short tons	11,715	2,928,750	3,258	5,555,469
Nickel in matte (a) "	21,371	10,685,500		
Iron ore (b) "	68,616	60,958	391	563,782
Iron, pig (c) "	76,164	2,204,205	761	1,351,601
Lead, pig lbs.	2,232,253	179,714	110	136,474
Copper "	6,825,772	1,041,994		
Nickel, metallic "	11,015,692	3,852,141	(d) 749	1,149,414
Nickel oxide "	4,890,571	1,151,490		
Platinum metals ounces	10,056	1,996,535		
Cobalt, metallic lbs.	167,750	392,926		
Cobalt oxide "	569,182	1,210,810	(e) 516	619,632
Other Cobalt and Nickel compounds "	161,442	16,991		
Total metallic		48,281,553	9,722	15,148,657
NON-METALLIC.				
Actinolite tons	100	1,160	9	939
Arsenic, crude and white lbs.	3,781,389	432,434	(e)	(e)
Clay products—($4,735,154).				
Brick, common M	123,551	2,209,265		
Brick, fancy and pressed "	32,559	809,126		
Tile, drain "	9,784	359,373	1,793	1,772,494
Tile, building and roofing tons	58,737	369,530		
Pottery		127,049	46	55,256
Sewer pipe		860,811	264	320,880
Cement, Portland bbls.	2,035,594	4,377,814	859	1,283,359
Corundum tons	196	27,000	19	32,000
Feldspar "	37,335	268,295	250	167,165
Fluorspar "	3,704	67,381	57	59,986
Graphite, crude and refined "	1,956	132,882	97	70,552
Gypsum, crushed, ground and calcined "	74,707	404,162	178	220,795
Iron pyrites "	148,651	618,283	292	380,376
Lime bush.	4,982,912	1,799,763	448	568,513
Mica tons	719	54,169	42	36,741
Mineral water Imp. gals.	127,150	15,059	20	10,643
Natural gas M. cu. ft.	10,545,000	3,163,500	683	625,215
Peat tons	3,900	15,600	28	14,622
Petroleum, crude bbls	181,750	724,145	(f) 1,736	2,695,507
Quartz and silica brick tons	94,650	366,441	82	82,549
Salt "	206,612	1,544,867	338	442,004
Sand and gravel cu. yds.	2,162,241	1,390,704	620	506,156
Sand-lime brick M	27,703	407,766	146	154,402
Stone, building, trap, granite, etc		3,944,972	961	1,037,832
Talc, crude and ground tons	20,359	306,319	60	77,818
Total non-metallic		24,797,969	9,028	10,615,847
		48,281,553	9,722	15,148,605
Add metallic				
Grand total		73,079,522	18,750	25,764,461

(a) Copper and nickel in the matte valued at 10 and 20 cents per pound respectively.
(b) Exports and shipments to points other than Ontario blast furnaces. Total shipments of iron ore, 126,710 tons valued at $510,000.
(c) Production from Ontario ore only. Total output of blast furnaces, 748,173 tons of pig iron, worth $21,652,308.
(d) Employees and wages for nickel-copper refining operations.
(e) Employees and wages for silver-cobalt refineries.
(f) Employees and wages for petroleum refineries

The value of metals produced in 1920 was greater than for any pre-war year, while the non-metallic valuation was the largest in Ontario's history. The following comparative statement shows the course of the mining industry during the five-year period, 1916 to 1920 inclusive, as indicated by the value of the total production:

TABLE II.—VALUE OF MINERAL PRODUCTION, 1916 TO 1920.

Product.	1916	1917	1918	1919	1920
METALLIC:	$	$	$	$	$
Gold	10,339,259	8,698,735	8,502,480	10,451,709	11,686,043
Silver	12,703,591	16,183,208	17,415,882	12,904,312	10,873,496
Platinum metals	.....	.....	.....	200,000	1,996,535
Cobalt (*a*)	762,327	1,122,779	1,615,130	868,107	1,603,736
Copper	8,365,255	7,961,662	8,532,790	3,709,687	3,970,744
Nickel (*b*)	20,685,564	21,041,956	27,840,422	11,925,229	15,689,131
Other Nickel and Cobalt compounds	60,956	42,026	73,347	188,083	16,959
Iron Ore (*c*)	342,700	483,690	624,364	48,341	60,981
Pig iron (*d*)	1,646,010	1,016,699	1,364,736	1,200,793	2,204,205
Lead (pig)	70,863	172,601	149,841	94,507	179,714
Molybdenite	26,393	108,501	59,067	.....	.....
Metallic production	55,002,918	56,831,857	66,178,059	41,590,759	48,281,553
NON-METALLIC:					
Actinolite	.....	1,320	2,508	1,176	1,160
Arsenic	200,103	608,483	566,332	485,360	432,434
Asbestos	100	2,150	.....	.....	.....
Barite	.....	.....	900	.....	.....
Brick, common and sand-lime	509,559	800,983	756,962	2,334,526	2,617,031
Brick, fancy, and pressed	318,942	474,614	396,698	539,908	809,126
Cement, Portland	2,242,433	2,934,271	1,910,839	3,659,720	4,377,814
Corundum	8,763	31,213	26,120	.....	27,000
Feldspar	42,159	81,802	111,173	88,663	268,295
Fluorspar	10,146	66,474	153,190	60,389	67,381
Graphite	249,586	296,587	208,848	99,841	132,882
Gypsum	116,206	130,138	151,564	278,111	404,162
Iron pyrites	471,807	1,111,264	1,144,737	366,422	618,283
Lime	265,356	657,364	872,177	1,268,290	1,799,763
Mica	55,407	92,453	49,575	56,199	54,169
Mineral water	(*e*)	(*e*)	133,808	19,290	15,059
Natural gas	2,404 499	3,220,123	2,498,769	2,583,324	3,163,500
Peat fuel	.....	.....	.....	1,750	15,600
Petroleum (crude)	387,846	475,000	781,097	632,789	724,145
Phosphate of lime (apatite)	.....	.....	.....	31	.....
Pottery	87,025	94,501	88,275	119,551	127,049
Quartz (silica)	223,514	358,674	452,711	179,070	366,441
Salt	700,515	1,047,707	1,287,039	1,395,368	1,544,867
Sand and gravel	470,963	431,597	553,638	501,666	1,390,704
Sewer pipe	216,749	378,923	362,536	609,100	860,811
Stone, building, crushed, etc	755,313	939,052	869,239	1,230,922	3,944,972
Talc, crude and ground	111,489	179,554	246,691	240,399	306,319
Tile, drain	275,471	546,040	309,899	354,700	359,373
Tile, building and roofing	176,953	301,688	195,588	186,592	369,530
Non-metallic production	10,300,904	15,261,975	14,130,913	17,293,157	24,797,969
Add metallic production	55,002,918	56,831,857	66,178,059	41,590,759	48,281,553
Total production	65,303,822	72,093,832	80,308,972	58,883,916	73,079,522

(*a*) Cobalt oxide and metallic cobalt..
(*b*) Nickel in matte, oxide and metallic nickel.
(*c*) Exports and shipments to points other than Ontario blast furnaces.
(*d*) Product from Ontario ore only.
(*e*) Production figures not collected.

In Table III is given the aggregate value of the metals and metallic products since the several substances began to be produced in Ontario down to the end of 1920. It should be pointed out that since 1914 the statistics of annual production credit pig iron only with the value of the pig iron product made from Ontario ore. This is but a small part of the total output, since the great bulk of the iron ore charged into the blast furnaces of the Province comes from the mines of Michigan and Minnesota. Conversely, part of the iron ore raised in Ontario is exported to the United States in the form of briquettes produced from low-grade magnetite ores. In the production tables credit is taken only for the ore exported or shipped to points other than Ontario blast furnaces, since to include the value of the ore converted into pig iron at home would involve a duplication of this item.

TABLE III. VALUE OF TOTAL PRODUCTION OF METALS IN ONTARIO.

Metal or Product	Production to 31st December, 1919	Production, 1920	Production to 31st December, 1920
	$	$	$
Gold	61,316,572	11,686,043	73,002,615
Silver	197,931,902	10,873,496	208,805,398
Platinum metals	1,500,000	1,996,535	3,496,535
Cobalt, including Cobalt oxide	6,787,006	1,603,736	8,390,742
Nickel, including Nickel oxide	149,935,762	15,689,131	165,624,893
Other Cobalt and Nickel compounds	418,828	16,991	435,819
Copper	53,656,767	3,970,744	57,627,511
Iron Ore	9,350,276	60,958	9,411,234
Pig Iron	80,126,710	2,204,205	82,330,915
Lead	605,102	179,714	784,816
Zinc Ore	92,410		92,410
Molybdenite	209,735		209,735
Total	561,931,070	48,281,553	610,212,623

Gold

For some years prior to 1903 the value of Ontario's output of gold exceeded that of silver. This position was reversed in 1904 when the silver mines of Cobalt began production. The pendulum has swung back again, and the gold production for 1920 exceeds that of silver. Despite labour scarcity and high operating costs for the first nine months of the year, followed by shortage of hydro-electric power during the last quarter, the yield of Ontario's gold mines was the largest in the history of the Province. The climb upward began with the discovery of Porcupine in 1909. Porcupine and Kirkland Lake are now recognized as important gold camps which have yet to reach their zenith of production.

Canada in the year 1920, owing to Ontario's contribution, was the only important gold-producing country in the world to show an increase in output over 1919. The decline in the world's gold production has been continuous since 1915, the year of maximum output, when 168.7 million dollars were produced. The following table shows the output in millions of dollars of leading countries and states for the last pre-war year, 1915, 1919 and 1920.

OUTPUT OF LEADING GOLD-PRODUCING COUNTRIES‡
(Millions of Dollars)

Source	1913	1915	1919	1920
World	459.9	468.7	365.2	334.9
Transvaal	182.0	188.0	172.2	168.6
United States	88.9	101.0	60.3	51.2
Australasia	51.8	49.0	26.1	23.5
Canada	16.6	19.0	15.8	15.9
Mexico	19.3	6.6	15.7	15.3
California	20.4	21.4	17.4	14.8
West Australia	27.1	25.0	15.2	12.8
ONTARIO	4.6	8.5	10.5	11.7
Rhodesia	14.1	18.9	12.3	11.4
India	11.2	11.5	10.5	9.0
Russia and Siberia	....	26.3	11.0	1.4

‡ Figures abstracted from annual reports by the Director of the U.S. Mint.

The list of producing gold mines in Ontario was as follows:—

PRODUCING GOLD MINES, 1920

Name of Company.	Name of Mine.	Locality.	P.O. Address of Manager, etc.
Argonaut Gold, Limited	Argonaut	Gauthier tp.	Dane.
Contact Bay Mines, Ltd.	Contact Bay	Van Horne tp.	Dryden.
Davidson Consolidated Gold Mines, Limited	Davidson	Porcupine	South Porcupine.
Dome Lake Mining and Milling Company, Limited	Dome Lake	Porcupine	South Porcupine.
Dome Mines Company, Limited	Dome and Dome Extension	Porcupine	South Porcupine.
Hollinger Consolidated Gold Mines, Limited	Hollinger	Porcupine	Timmins.
Jackson, W. S.		Schreiber	Fort William.
Kirkland Lake Gold Mining Company, Limited	Kirkland Lake	Kirkland Lake	Kirkland Lake.
Lake Shore Mines, Limited	Lake Shore	Kirkland Lake	Kirkland Lake.
McIntyre-Porcupine Mines, Limited	McIntyre	Porcupine	Schumacher.
*Northcrown Porcupine Mines, Ltd.	Northcrown,	Porcupine	Timmins.
Porcupine Crown Mines, Ltd.	Porcupine Crown	Porcupine	Timmins.
Stone, W. E.	A.L. 113	Mine Centre	Mine Centre.
Teck-Hughes Gold Mines, Limited	Teck-Hughes	Kirkland Lake	Kirkland Lake.

*Operated under the new name "Northcrown Porcupine Mines, Ltd.," after May 15th, 1920, when the Porcupine Crown and Thompson-Krist mines were amalgamated.

Details of production are given in Table IV which follows:—

TABLE IV.—ONTARIO'S GOLD PRODUCTION, 1920.

Mine or Source	Ore milled tons	Gold Production		Silver Production		Total Value, gold and silver	Extraction per ton milled
		Fine ounces	Value	Fine ounces	Value		
PORCUPINE:			$ c.		$ c.	$ c.	$ c.
Davidson Consolidated	3,003	478.482	11,210 29	35.40	35 76	11,246 05	3 70
Dome Lake	4,707	2,264.370	46,809 11	334.18	360 66	47,169 77	10 02
Dome	295,220	97,022.887	2,005,640 87	14,779.55	14,927 53	2,020,568 40	6 84
Hollinger Consolidated	650,205	298,222.783	6,164,264 92	55,802.77	55,399 88	6,219,664 80	9 56
McIntyre Porcupine	191,032	106,526.790	2,202,100 50	21,706.04	20,981 94	2,222,082 44	11 64
Northerown Porcupine	11,678	4,675.579	96,584 37	801.01	716 72	168,830 31	9 43
Porcupine Crown	6,220	3,434.346	70,962 46	513.62	566 76		
Total Porcupine	1,162,065	512,625.237	10,597,572 52	93,972.57	92,989 25	10,689,561 77	9 20
KIRKLAND LAKE:							
Kirkland Lake	40,812	13,795.130	285,170 67	1,852.93	1,730 20	286,900 87	7 03
Lake Shore	19,779	24,291.888	502,113 34	1,722.99	1,621 62	503,734 96	25 47
Teck-Hughes	30,646	11,909.656	246,194 28	1,507.91	1,562 76	247,757 04	8 08
Total Kirkland Lake	91,237	49,996.674	1,033,478 29	5,083.83	4,914 58	1,038,392 87	11 38
MISCELLANEOUS:							
Argonaut (Gauthier tp.)	4,637	1,290.560	26,678 25	171.74	184 64	26,862 89	5 79
Contact Bay (Wabigoen Lake)	291	101.270	2,093 27	25.75	16 97	2,110 24	7 25
Jacksen, W. S., (Schreiber)	1	3.000	62 01	1.05	74	62 75	.....
Stone, W. E., (Mine Centre)	2	5.181	107 10	1.55	1 28	108 38	.....
Nickel-Copper Refineries	.....	1,260.600	26,052 00	.....	.....	26,052 00	.....
Total Miscellaneous	4,931	2,660.611	54,992 63	200.09	203 63	34,949 56	.....
Grand Total	1,258,233	565,282.520	11,686,043 44	99,256.49	98,107 46	11,762,904 20	.....

Gold-producing companies receive payment in New York funds irrespective of whether shipments are consigned to the Canadian or United States Mints. In consequence they reap the advantage of the exchange premium, which amounted to $1,376,275 or 11.7 per cent in 1920.

In the following table the total gold output of the Province is given, also that from Porcupine and Kirkland Lake beginning in 1910 and 1913 respectively:—

TABLE V.—TOTAL GOLD PRODUCTION OF ONTARIO.

Year	Total Production	Porcupine		Kirkland Lake	
	$	$	Per Cent.	$	Per Cent.
1892–1909	2,509,492				
1910	68,498	35,539	51.8		
1911	42,637	15,437	36.2		
1912	2,114,086	1,730,628	81.8		
1913	4,558,518	4,294,113	94.1	65.260	1.2
1914	5,529,767	5,190,794	93.8	114.154	2.0
1915	8,501,391	7,536,275	88.6	551,069	6.5
1916	10,339,259	9,397,536	90.8	702.761	6.8
1917	8,698,735.	8,229,744	94.5	404,346	4.6
1918	8,502,480	7,767,907	91.4	632,007	7.4
1919	10,451,709	9,941,804	95.1	486,809	4.7
1920	11,686,043	10.597,573	90.7	1,033,478	8.8
Total	73,002,615	64,737,350	88.7	3,989,884	5.5

Dividends.—The important period of gold mining in Ontario began with the opening of the Porcupine mines in 1910. Since that time the gold mines have paid out in returns to shareholders a total of $17,551,541.65, details of which are given in Table VI.

TABLE VI.—DIVIDENDS AND BONUSES PAID BY GOLD MINING COMPANIES TO DECEMBER 31, 1920.

Name of Company	Date of Incorporation	Authorized Capital	Capital Stock Issued	Par value per share	Amount of Dividends and Bonuses paid to end of 1919	Amount of Dividends and Bonuses paid during 1920	Rate per cent.	Total of Dividends and Bonuses paid to Dec. 31st, 1920	Date when last Dividend or Bonus paid
		$	$	$ c.	$	$ c.		$	
Dome Mines Company, Ltd.	Mar. 23, 1910	5,000,000	4,766,670	10 00	1,500,000 00	416,886 00	10	1,916,886 00	Oct. 20, 1920
*Hollinger Consolidated Gold Mines, Ltd.	June 16, 1916	25,000,000	24,600,000	5 00	11,146,000 00	2,214,000 00	9	13,360,000 00	Dec. 31, 1920
Lake Shore Gold Mines, Ltd.	Feb. 25, 1914	2,000,000	2,000,000	1 00	200,000 00	80,000 00	4	280,000 00	Oct. 1, 1920
McIntyre-Porcupine Mines, Ltd.	Mar. 16, 1911	4,000,000	3,640,283	1 00	1,448,613 20	546,042 45	15	1,994,655 65	Sept. 1, 1920
Porcupine Crown Mines, Ltd.	May 26, 1913	2,000,000	2,000,000	1 00	840,000 00			840,000 00	July 15, 1917
†Rea Consolidated Gold Mines	April 5, 1911	1,000,000	200,000	5 00	12,000 00			12,000 00	1913
Tough-Oakes Gold Mines, Ltd.	July 15, 1913	3,000,000	2,657,500	5 00	398,625 00			398,625 00	Dec. 27, 1916
Total					13,359,209 90	3,256,928 45		17,551,541 65	

*Hollinger Consolidated Gold Mines, Limited, is a consolidation of the Acme Gold Mines, Limited, Millerton Gold Mines, Limited, and Hollinger Gold Mines, Limited. Dividends include $160,000 paid by Acme prior to the amalgamation.

†The dividend paid was by the lessee, Mines, Leasing and Development Company, Limited.

Silver-Cobalt

On January 12th the price of silver was $1.37 per ounce, the highest on record during the history of the Cobalt camp. The decline which followed was gradual until the lowest quotation for the year, 59¼ cents per ounce for foreign silver on the New York market, was reached on Dec. 10th. This fall in price accompanied by hydro-electric power shortage late in the year, due to scanty precipitation during the summer and fall, resulted in certain mines closing down or curtailing output.

Gowganda's silver production came from the Miller Lake O'Brien, Bonsall and Castle mines, the last mentioned being operated by the Trethewey Silver Cobalt Mining Company.

In addition to the silver content of the ores, concentrates, residues, etc., the producing mines in many cases are paid for the cobalt contained in them. Returns show that for 987,141 pounds of cobalt recovered and paid for, the producing companies received $561,974 from consignees in southern Ontario, England and the United States, or an average of 57.8 cents per lb. The price realized was much higher than in former years.

Since the discovery of silver at Cobalt in 1903 shipments from the camp and outlying silver areas have been as follows:—

Year.	Average price, cents per ounce.	Ounces.	Value $
1904	57.2	206,875	111,887
1905	60.4	2,451,356	1,360,503
1906	66.8	5,401,766	3,667,551
1907	67.5	10,023,311	6,155,391
1908	52.9	19,437,875	9,133 378
1909	51.5	25,897,825	12,461,576
1910	53.5	30,645,181	15,478,047
1911	53.3	31,507,791	15,953,847
1912	60.8	30,243,859	17,408,935
1913	57.8	29 681,975	16,553,981
1914	54.8	25,162,841	12,765,461
1915	49.69	24,746,534	12,135,816
1916	65.661	19,915,090	12,643,175
1917	81.417	19,401,893	16,121,013
1918	96.772	17,661,694	17,341 790
1919	111.122	11,214,317	12,738,994
1920	100.900	10,846,321	10,654,471
Total to end of 1920	.....	314,446,506	192,685,816

Mines shipping over a quarter million ounces of silver in 1920 are given in order:

Mine.	Ounces.
Nipissing	3,390,537
Mining Corporation of Canada	1,806,274
O'Brien	1,179,706
Coniagas	990,176
McKinley-Darragh-Savage	613,428
Kerr Lake	610,604
La Rose	492,801
Miller Lake O'Brien	376,417
Temiskaming	298,627

Classified according to source, the output of silver in 1920 was derived as follows:—

	Ounces.
Cobalt	10,402,250
South Lorrain	8,252
Gowganda	433,352
Cane township, Maple Mountain and Silver Islet	2,467
Recovered from gold ores	99,255
Recovered from nickel-copper refining	119,839
Total	11,065,415

The producers of silver are given in the following list:—

SILVER PRODUCERS IN 1920.

Operator.	Mine or Source.	Location.
Aladdin Cobalt Company, Limited	Chambers-Ferland	Cobalt.
Angus, D. H	Cobalt Silver Queen (lease)	Cobalt.
Bailey Silver Mines, Limited	Bailey	Cobalt.
Beaver Consolidated Mines, Limited	Beaver	Cobalt.
Bonsall Mines, Limited	Bonsall	Gowganda.
Brewer and Brewer	Cobalt Silver Queen (lease)	Cobalt.
Cane Silver Mines, Limited	Cane	Cane tp.
Central Operating Company	Foster (lease)	Cobalt.
Cobalt Provincial Mining Co., Limited	Provincial	Cobalt.
Colonial Mining Company, Limited	Colonial	Cobalt.
Coniagas Mines, Limited	Coniagas and Trethewey	Cobalt.
Crown Reserve Mining Company, Ltd	Crown Reserve	Cobalt.
Devlin and Enright	Devlin	James tp.
Edwards & Wright, Ltd	Green-Meehan	North Cobalt.
Hargrave Consolidated Mines, Limited	Hargrave	Cobalt.
Hudson Bay Mines, Limited	Hudson Bay	Cobalt.
Islet Exploration Co., Ltd	Silver Islet	Thunder Bay Dist.
Keeley Silver Mines, Limited	Keeley	South Lorrain.
Kerr Lake Mining Company, Limited	Kerr Lake	Cobalt.
Lansdowne, E. T	Silver-cobalt plant clean-up	Copper Cliff.
La Rose Mines, Limited	La Rose	Cobalt.
McDonald Syndicate	Ruby (lease)	Cobalt.
McKinley-Darragh-Savage Mines of Cobalt, Limited	McKinley-Darragh-Savage	Cobalt.
Mining Corporation of Canada, Limited, The	Cobalt Lake, Townsite-City, Buffalo	Cobalt.
Nipissing Mining Company, Limited	Nipissing	Cobalt.
Northern Customs Concentrators, Ltd	Silver Cliff and Chambers-Ferland	Cobalt.
O'Brien, M. J., Limited	O'Brien	Cobalt.
" "	Miller Lake O'Brien	Gowganda.
Peterson Lake Silver Cobalt Mining Co., Limited	Peterson Lake	Cobalt.
Post, W. J	Silver Queen (lease)	Cobalt.
Reeve-Dobie Mines, Limited	Reeve-Dobie	Gowganda.
Reliance Silver Mines, Ltd	Reliance	Cobalt.
Right of Way Mines, Limited	Right of Way	Cobalt.
Smith, J. G. and E. C	Kell	Gowganda.
Temiskaming Mining Company, Limited	Temiskaming	Cobalt.
Trethewey Silver-Cobalt Mine, Limited	Castle	Gowganda.
White Reserve Mining Co., Limited	White Reserve	Maple Mountain.

In Table VII are shown the shipments of ore, concentrates and bullion from the mines of Cobalt, Gowganda and outlying silver areas since mining began in 1904. By "shipment" is meant consignment to outside points whether in Canada or the United States, but not movements within the camp, as for example, ore hauled or shipped by rail from a mine to a concentrating or reduction plant in Cobalt itself. It will be noted that the quantity of ore shipped away from the camp has been reduced to relatively small proportions.

TABLE VII.—SHIPMENTS FROM SILVER MINES, 1904 TO 1920

Year.	No. of Producing Mines.	Ore			Concentrates and Residues.			Bullion.	Total.	
		Tons.	Silver, Ounces	Av. per ton. Oz.	Tons.	Silver, Ounces	Av. per ton. Oz.	Ounces	Ounces.	Value. $
1904..	4	158	206,875	1,309					206,875	111,887
1905..	16	2,144	2,451,356	1,143					2,451,356	1,360,503
1906..	17	5,335	5,401,766	1,013					5,401,766	3,667,551
1907..	28	14,788	10,023,311	677					10,023,311	6,155,391
1908..	30	24,487	18,022,480	736	1,137	1,415,395	1,244		19,437,875	9,133,378
1909..	31	27,729	22,436,355	809	2,948	3,461,470	1,714		25,897,825	12,461,576
1910..	41	27,437	22,581,714	821	6,845	7,082,834	1,030	980,633	30,645,181	15,478,047
1911..	34	17,278	20,318,626	1,176	9,375	8,056,189	858	3,132,976	31,507,791	15,953,847
1912..	30	10,719	15,395,504	1,436	11,214	9,768,228	871	5,080,127	30,243,859	17,408,935
1913..	35	9,861	13,668,079	1,386	10,016	8,489,321	770	7,524,575	29,681,975	16,553,981
1914..	32	4,302	6,504,753	1,511	12,152	8,915,958	733	9,742,130	25,162,841	12,765,461
1915..	24	2,865	6,758,286	2,359	11,996	10,001,548	834	7,986,700	24,746,534	12,135,816
1916..	28	2,177	4,672,500	2,146	8,561	7,598,011	887	7,644,579	19,915,090	12,643,175
1917..	28	2,288	3,271,353	1,429	13,720	6,445,243	469	8,053,318	19,401,893	16,121,013
1918..	38	1,456	1,401,950	962	17,958	5,793,756	323	10,466,888	17,661,694	17,341,790
1919..	33	850	806,341	949	15,208	4,024,764	265	6,383,764	11,214,317	12,738,994
1920..	35	578	668,081	1,152	9,757	3,777,812	387	6,402,423	10,846,321	10,654,471
Total.	....	154,452	154,586,430	1,001	131,887	84,859 977	643	73,398,113	314,446,504	192,685,816

Treatment and Reduction Plants.—Following is a synopsis of the operation of plants at Cobalt which treat custom or purchased ores by way of sampling, concentration or reduction to bullion. Employees engaged in these works numbered 338 and their wages amounted to $536,455.

*ORE SAMPLING, CONCENTRATION AND REDUCTION WORKS, 1920.

Firm	Ore sampled	Ore and Tailings treated	Concentrates sampled	Concentrates produced	Concentrates treated	Base Bullion, etc., treated
	tons	tons	tons	tons	tons	lbs.
Cobalt Reduction Company		11,593			392	3,462
Dominion Reduction Company		43,006				
Nipissing Mining Company, Ltd		229				8,637
Northern Customs Concentrators, Ltd		14,622		423		
Temiskaming Testing Laboratories	436		940			
Total	436	69,450	423	940	392	12,099

*Treatment of Customs or Purchased Ore only.

TABLE VIII.—TOTAL SHIPMENTS FROM SILVER MINES, 1904 TO 1920.

Year.	Copper (a)		Lead (a)		Nickel (b)		Cobalt (c)		Arsenic		Silver		Total Value.
	Tons	Value	Tons	Value	Tons	Value	Tons	Value	Tons	Value	Ounces	Value	
		$		$		$		$		$		$	$
1904					14	3,467	16	19,960	72	903	206,875	111,887	136,217
1905					75	10,000	118	100,000	549	2,693	2,451,356	1,360,503	1,473,196
1906					160	.....	321	80,704	1,440	15,858	5,401,766	3,667,551	3,764,113
1907					370	1,174	739	104,426	2,958	40,104	10,023,311	6,155,391	6,301,095
1908					612	.....	1,224	111,118	3,672	40,373	19,437,875	9,133,378	9,284,869
1909					766	.....	1,533	94,965	4,294	61,039	25,897,181	12,461,576	12,617,580
1910					504	.....	1,098	54,699	4,897	70,709	30,645,825	15,478,047	15,603,455
1911					392	.....	852	170,890	3,806	74,609	31,507,791	15,953,847	16,199,346
1912					429	14,220	934	314,381	4,166	80,546	30,243,859	17,408,935	17,818,082
1913					377	13,326	821	420,386	3,663	64,146	29,681,975	16,553,981	17,051,839
1914 (d)					90	28,978	351	590,406	2,030	116,624	25,162,841	12,765,461	13,501,469
1915					35	28,353	206	383,261	2,490	148,379	24,746,534	12,135,816	12,695,809
1916					79	59,380	400	805,014	2,160	200,103	19,915,090	12,643,175	13,707,672
1917	52	28,840			155	125,071	337	1,138,190	2,592	608,483	19,401,893	16,121,013	18,021,597
1918	72	35,712	3	453	186	156,893	380	1,640,310	2,545	566,332	17,661,694	17,341,790	19,741,490
1919	110	40,976	12	1,296	276	188,418	298	1,019,479	2,834	485,360	11,214,317	12,738,994	14,474,523
1920	50	17,494	5	792	127	93,233	283	1,605,365	1,883	431,527	10,846,321	10,654,471	12,802,882
Total	285	123,022	20	2,541	4,647	722,513	9,911	8,653,554	4,605	3,007,788	314,446,504	192,658,816	205,195,234

(a) Copper and lead are recovered from certain silver ores and concentrates shipped to United States refineries. These metals are valued at the average prices for the year, namely: copper, 17.5 cents and lead 8.0 cents per pound in 1920.

(b) Metals and metallic contents of all Nickel compounds.

(c) Metals and metallic contents of all Cobalt compounds.

(d) Prior to 1914 an estimate based on assays was made of the nickel, cobalt and arsenic contained in the ores; subsequently actual recoveries have been reported.

Refineries.—The companies named hereunder with plants situated in southern Ontario, treat silver-cobalt ores, concentrates and residues:

REFINERS OF SILVER-COBALT ORES, 1920.

Name of Company	Location of Works	P.O. Address
Deloro Smelting and Refining Co., Limited	Deloro	Deloro.
Coniagas Reduction Co., Limited	Thorold	St. Catharines.
Metals Chemical, Limited*	Welland	Welland
Ontario Smelters & Refiners, Ltd	Welland	Welland.

*Metals Chemical, Limited sold the Welland plant in March, and after April 1st it was operated by Ontario Smelters and Refiners, Limited. The last mentioned company remodelled the plant and reported a small production, chiefly of cobalt and nickel oxides from residues on hand.

The operations of the refining companies during 1920 are summarized in the figures given below. Apart from the silver recovered, from Cobalt and outlying silver areas, the marketed by-products had a value of $2,135,330.

OPERATIONS OF SILVER-COBALT REFINERIES IN ONTARIO, 1920.

Schedule	Production	Marketed.	
	Quantity	Quantity	Value
			$
Ore treated tons	2,954		
Concentrates, treated "	1,242		
Residues, " "	4,792		
Silver fine ounces	3,464,212	3,334,724	3,485,144
Arsenic, Crude and White lbs.	3,999,801	3,765,611	431,527
Cobalt Oxide "	762,434	569,182	1,210,810
Cobalt Hydroxide, Sulphate, Acetate and Hydrate "	1,717	1,717	1,629
Cobalt, Metallic "	277,626	167,750	329,926
Nickel Oxide "	407,315	24,579	6,584
Nickel Sulphate and Carbonate "	159,725	159,725	15,362
Nickel, Metallic "	110,235	204,537	71,287
Copper Sulphate "	221,920	104,105	5,205
Total value of Products Marketed			5,620,474

The number of workmen employed in the refineries was 516 and the wages paid them amounted to $619,632.

The following figures have been compiled from information furnished by refineries in the United States which treated products from Ontario silver mines:—

Ore treated, tons	42
Concentrates treated, tons	1,957
Residues or slag treated, tons	30
Silver recovered, ounces	705,508
Gold recovered, ounces	584
Copper recovered, lbs.	99,964
Lead recovered, lbs.	9,528
Nickel recovered, lbs.	6,906

Shipments were consigned to the following:—
American Smelting and Refining Company, (Peublo Col., and Perth Amboy, N.J).
Pennsylvania Smelting Co., (Carnegie, Pa.).
United States Metal Refining Co., (Chrome, N.J.)

TABLE IX.—DIVIDENDS AND BONUSES PAID BY SILVER MINING COMPANIES TO DECEMBER 31, 1920.

Name of Company	Date of Incorporation	Authorized Capital	Capital Stock Issued	Par value per share	Amount of Dividends and Bonuses paid to end of 1919	Amount of Dividends and Bonuses paid during 1920	Rate per cent	Total of Dividends and Bonuses paid to 31st Dec., 1920	Date when last Dividend or Bonus paid
		$ c.	$ c.	$ c.	$ c.	$ c.		$ c.	
Aladdin Cobalt Company, Limited	Aug. 23, 1912	500,000	500,000	5 00	75,000 00			75,000	Apl. 30, 1917
Beaver Consolidated Mines, Ltd	Mar. 1, 1907	2,000,000	2,000,000	1 00	650,000 00	60,000 00	3	710,000 00	Apl. 8, 1916
Buffalo Mines, Ltd., The *(a)*	Apl. 27, 1906	500,000	500,000	50	2,787,000 00			2,787,000 00	May 28, 1914
Casey Cobalt Silver Mining Co., Limited	Dec. 19, 1906	100,000	100,000	1 00	203,249 33			203,249 33	Apl. 22, 1914
Cobalt Central Mines Co., Ltd	Dec. 13, 1905	5,000,000	5,000,000	1 00	192,845 00			192,845 00	Aug. 25, 1909
Cobalt Comet Mines, Ltd. *(b)*	Apl. 16, 1913	1,000,000	1,000,000	1 00	230,000 00			230,000 00	Apl. 1, 1915
Cobalt Silver Queen, Ltd	Apl. 1, 1906	1,500,000	1,500,000	1 00	315,000 00			315,000 00	Dec. 31, 1908
Coniagas Mines, Limited, The	Nov. 24, 1906	4,000,000	4,000,000	5 00	9,640,000 00	1,100,000 00	7½	10,740,000 00	Dec. 22, 1920
Crown Reserve Mining Co., Ltd	Jan. 16, 1907	2,000,000	1,999,957	1 00	6,190,849 00			6,190,849 00	Dec. 28, 1916
Foster Cobalt Mining Co., Ltd	Feb. 14, 1906	1,000,000	915,588	1 00	45,000 00			45,000 00	Jan. 1, 1907
Hudson Bay Mines, Ltd	July 16, 1909	3,500,000	3,200,050	5 00	778,909 42			778,909 42	Aug. 31, 1913
Kerr Lake Mining Company, Ltd	Aug. 9, 1905	40,000	40,000	100 00	8,785,000 00	80,000 00	200	8,865,000 00	Oct. 11, 1920
La Rose Mines, Ltd	May 31, 1908	1,500,000	1,500,000	1 00	6,300,546 84			6,300,546 84	Apl. 20, 1918
McKinley-Darragh-Savage Mines of Cobalt, Ltd	Apl. 27, 1906	2,500,000	2,247,692	1 00	5,685,668 88	269,723 04	12	5,955,391 86	Oct. 1, 1920
Mining Corporation of Canada, Ltd. *(c)*	Nov. 23, 1916	8,300,250	8,300,250	5 00	4,877,349 22	622,518 75	7½	5,499,867 87	Sept. 15, 1920
City of Cobalt Mining Co., Ltd. *(d)*	Oct. 5, 1906	500,000	1,5000,000	1 00	145,000 00			145,000 00	Apl. 15, 1920
	Jan. 7, 1909	1,500,000							
Cobalt Lake Mining Co., Ltd. *(d)*	Dec. 22, 1906	3,000,000	3,000,000	1 00	465,000 00			465,000 00	May 29, 1914

TABLE IX.—*Continued.*

Name of Company	Date of Incorporation	Authorized Capital	Capital Stock Issued	Par value per share	Amount of Dividends and Bonuses paid to end of ~~1918~~ 1919	Amount of Dividends and Bonuses paid during ~~1919~~ 1920	Rate per cent.	Total of Dividends and Bonuses paid to 31st Dec., ~~1919~~ 1920	Date when last Dividend or Bonus was paid
		$ c.	$ c.	$ c.	$ c.	$ c.		$ c.	
Cobalt Townsite Mining Co., Ltd. (*d*)	May 8, 1906	100,000	45,011	1 00	1,042,259 61			1,042,259 61	Nov. 11, 1914
Nipissing Mining Co., Ltd. (*e*)	Dec. 16, 1904	250,000	250,000	100 00	21,283,297 25	1,835,000 00	734	23,118,297 25	Oct. 20, 1920
Penn-Canadian Mines, Ltd. (*f*)	Apl. 24, 1912	1,500,000	1,349,705	1 00	175,461 65			175,461 65	Sept. 10, 1917
Peterson Lake Silver-Cobalt Mining Co., Ltd.	Apl. 11, 1906	3,000,000	2,469,802	1 00	462,350 35			462,350 35	Jan. 2, 1917
Right of Way Mining Co., Ltd	July 13, 1906	500,000	499,518	1 00	324,643 93			324,643 93	Oct. 1, 1909
Right of Way Mines, Ltd	Sept. 11, 1909	2,000,000	1,685,500	1 00	252,825 00			252,825 00	Mar. 17, 1917
Seneca-Superior Silver Mines, Ltd	Sept. 29, 1911	500,000	478,884	1 00	1,579,817 20			1,579,817 20	Dec. 15, 1916
Temiskaming Mining Co., Ltd	Nov. 5, 1906	2,500,000	2,500,000	1 00	2,059,156 25	100,000 00	4	2,159,156 25	Jan. 31, 1920
Temiskaming and Hudson Bay Mining Co., Ltd	July 10,1903	25,000	7,761	1 00	1,940,250 00			1,940,250 00	Nov. 10, 1914
Trethewey Silver Cobalt Mines, Ltd	May 30, 1906 June 1, 1911	2,000,000	1,000,000	1 00	1,211,998 50			1,211,998 50	Jan. 2, 1919
Wettlaufer Lorrain Silver Mines, Ltd	Nov. 30, 1908	1,5000,00	1,416,590	1 00	637,465 50			637,465 50	Sept. 22, 1913
Total					78,335,942 87	4,067,241 79		82,403,184 66	

(*a*) In 1917 the capital stock of the company was reduced from $1000,000 to $750,000, in 1918 from $750,000 to $500,000, and on December. 21 1919, from $500,000 to $150,000, by returning to shareholders amounts equal to the reduction in capital, leaving 300,000 shares issued of 50 cents each.
(*b*) Cash assets amounting to $50,000 paid on April 27, 1917.
(*c*) Mining Corporation of Canada, Limited, owns and operates the City of Cobalt, Cobalt Lake and Cobalt Townsite mines.
(*d*) Now owned and operated by Mining Corporation of Canada, Limited.
(*e*) Includes $16,288,297.25 paid in dividends by the Nipissing Mines Co. (the holding company) to the end of 1916.
(*f*) Paid out of capital $40,491.15 on Sept. 10, 1917, and an equal amount on April 24, 1918.

Nickel, Copper, and the Platinum Metals

The year 1920 marked the beginning of smelting and refining operations by the British America Nickel Corporation. The ore comes from the old Murray mine, which was found by diamond drilling to contain large reserves. In January the new smelter at Nickelton was put in blast. The resulting Bessemer nickel-copper matte, which is produced without preliminary roasting of the ore, is shipped to the electrolytic refinery at Deschênes on the Quebec side of the Ottawa river, near Hull. The new refinery, in which the Hybinette electrical process is employed, began operations during the second quarter of the year. Electrolytic nickel and copper are being produced, but no slimes have been treated for the recovery of gold, silver and metals of the platinum group.

The production of ore during the year from the several mines was as follows:—

		Tons
British America Nickel Corporation: —		
Murray		277,484
International Nickel Company of Canada: -		
Creighton		789,056
Mond Nickel Company: -		
Levack	31,820	
Garson	35,541	
Worthington	20,375	
Bruce	25,639	
Victoria No. 1	20,915	
		134,290
Total		1,200,830

In Table X given below is indicated the course of the nickel industry during the last five years. That this metal takes on added importance during times of war is sufficiently shown by the fact that while in 1914 the quantity of ore smelted was 947,053 tons, it rose in 1918 to 1,559,892 tons, and fell to 754,567 tons in 1919.

For the purpose of this table the nickel and copper in matte produced in 1920 were valued at 25 cents and 12½ cents per pound, respectively.

TABLE X. —NICKEL-COPPER MINING AND SMELTING, 1916-1920.

Schedule		1915	1916	1917	1919	1920
Ore raised	tons.	1,572,804	1,536,828	1,643,040	614,955	1,200,830
Ore smelted	"	1,546,215	1,453,661	1,559,892	754,567	1,087,531
Bessemer matte produced	"	80,010	78,897	87,184	42,735	57,938
Nickel contents of matte	"	41,299	41,887	45,886	22,035	30,615
Copper contents of matte	"	22,430	21,197	23,843	12,099	16,021
Value of Nickel in matte	$	20,649,279	20,943,500	27,531,600	11,017,500	15,307,350
Value of Copper in matte	$	8,299,051	6,842,890	8,453,880	3,387,720	4,005,300
Wages paid	$	4,920,720	5,570,587	7,861,773	3,382,154	5,555,469
Men employed	No.	4,730	3,356	3,145	2,536	3,258

The following figures summarize the operations of the International Nickel Company of Canada's refinery at Port Colborne and that of the British America Nickel Corporation at Deschênes:—

TABLE XI.—NICKEL-COPPER REFINING, 1920.

Schedule		Quantity	Value
		$	$
Matte treated	tons	17,297	
Nickel Oxide marketed	lbs.	4,866,001	1,144,906
Metallic Nickel recovered	"	10,811,155	3,780,854
Blister Copper and Electrolytic Copper recovered	"	6,695,596	1,019,258
Gold	ounces	290.26	5,805
Silver recovered	"	37,957	33,884
Platinum metals	"	282.04	18,009
Total value of Products			6,002,716
Employees	No.	749	
Wages paid	$		1,149,414

Returns by United States refineries from Ontario gold and silver ores treated show a recovery of 100,176 pounds of copper and 6,906 pounds of nickel. The average New York price of electrolytic copper was 17.456 cents per pound for the full year, as compared with 18.691 cents in 1919. During the last quarter of the year, the market for nickel and copper was dull, prices dropped and stocks accumulated. In consequence, the International Nickel Company of Canada curtailed its output by 25 per cent. on November 1st, thereby reducing production to 3,000 tons of nickel-copper matte and 400 tons of refined nickel per month. A further reduction in output has since been made by this company. The mine and smelter of the British America Nickel Corporation closed down on February 26th, 1921. Similar action will follow at the refinery as soon as matte shipped from the smelter has been treated. Vice-President W. A. Carlyle states that this action became necessary owing to bad market conditions for the products, nickel and copper.

Platinum Metals.—Nickel-copper ores from Sudbury carry appreciable quantities of gold, silver, platinum, palladium and other metals of the platinum group. Recoveries made from the Mond Nickel Company's mattes have been published in a recent bulletin on Platinum, issued by the Imperial Institute of London. The figures follow: Platinum, 3,722 ounces in 1916, 4,719 ounces in 1917 and 4,958 ounces in 1918. In 1915 the Mond mattes were estimated to contain 3,078 ounces of platinum, 5,474 ounces of palladium and 973 ounces of iridium and rhodium. In 1919 from mattes treated by the International Company at Port Colborne, Ont., and Bayonne N.J., there was a recovery of 1,770 ounces of platinum-group metals, of which 642 ounces were platinum. These figures place Ontario in third place among the platinum producing countries of the world, Russia and Colombia alone having a greater production.

Recoveries of platinum metals in 1920 as reported to the Ontario Department of Mines by the Mond Nickel Company in Great Britain and the International Nickel Company in the United States were as follows: platinum, 8,345 ounces; palladium 10,199 ounces; and rhodium group metals, 522 ounces. The average price of platinum for the year was $110.90 per fine ounce. Matte treated in the New Jersey refinery was 30,740 tons, but it must be borne in mind that the precious metals recovered do not bear a definite ratio to the matte treated for the reason that residues are allowed to accumulate over irregular periods and recoveries cannot be credited to the matte treated in any particular year.

Iron Ore

The quantity of the iron ore raised in 1920 was 187,867 tons. Roasted and nodulized siderite shipments from the Magpie mine of the Algoma Steel Corporation, and beneficiated magnetite in the form of briquettes by Moose Mountain, Limited, totalled 126,710 short tons, valued at $510,000. During the year 6,816 tons of briquettes worth $60,958 were shipped to points other than Ontario blast furnaces. Nearly ninety per cent. of the ore smelted was of foreign origin.

Following is a list of iron mines from which shipments were made during the year:—

SHIPPERS OF IRON ORE, 1920.

Company or Firm.	Mine.	Location.	Kind of Ore.	P.O. Address of Company.
Algoma Steel Corporation, Ltd	Magpie	Algoma dist	Siderite	Sault Ste. Marie.
Moose Mountain, Ltd.	Moose Mount'n	Hutton tp. (Sudbury dist.)	Magnetite	Sellwood.

In the United States 67,604,465 gross tons were mined in 1920. Shipments were 69,281,341 gross tons, according to U.S. Geological Survey figures, the average value of the iron ore at the mines being $4.11 per ton, as compared with $3.61 in 1919. Only during three war years, 1916-17-18, has this output been exceeded. It is interesting to note that 86 per cent. of the ore or 60 million tons came from the Lake Superior region. Of the "Lake" shipments 67 per cent. was of Minnesota origin and 31 per cent. from Michigan. The prices per ton of "Lake" ores were the highest on record, namely, $6.70 to $7.15 per gross ton depending on grade and metallic iron content which ranged from 51.5 to 55 per cent.

Pig Iron, Steel, Ferro-Alloys and Coke

Of the 1,493,837 tons of iron ore smelted in Ontario in 1920, there were 1,341,661 tons imported from the United States. Ontario ore smelted was 152,176 tons, or 10.18 per cent. of the total. Pig iron credited to Ontario in Tables I and II represents only that proportion of the total output equivalent to the percentage of domestic ore used. In addition to ore, furnaces were charged with limestone worth $535,029 and coke valued at $9,549,290.

Furnaces operated at Sault Ste. Marie, Hamilton, Port Colborne, and Midland. The stack at Parry Sound belonging to the Parry Sound Iron Company, Limited, has not been in blast since October 1st, 1919, and that of the Standard Iron Company, Limited, at Deseronto since June of 1919. The Midland stack was blown in on October 20th, 1920, after being idle since August, 1919. The Canadian Steel Corporation, Limited at Ojibway, a suburb of Windsor on the Detroit river, has two blast furnaces under construction, the capacity of each being 550 tons daily. To the end of 1920 about $4,000,000 had been expended on plant construction.

Both the Sault Ste. Marie and Hamilton plants produce open-hearth steel. In 1907 in the United States about 11,600,000 gross tons each of Bessemer and open-hearth steel were produced. In 1919 the ratio of open-hearth to Bessemer was nearly 4 to 1. The pig iron required for Bessemer steel is roughly 110 per cent. of the steel product, while in open-hearth furnaces pig iron represents 40 to 80 per cent. of the steel product, the manufacturer using "scrap" supply to supplement the pig.

IRON BLAST FURNACES IN OPERATION, 1920.

Name of Company.	Furnaces		Fuel used.	Location.
	Number.	Aver. days operated		
Algoma Steel Corporation, Limited...	4	318	Coke.....	Sault Ste. Marie.
Canadian Furnace Company, Limited.	1	318	Coke.....	Port Colborne.
Midland Iron and Steel Co., Ltd.....	1	72	Coke.....	Midland.
Steel Company of Canada, Limited...	2	250	Coke.....	Hamilton.

The following table gives particulars of the iron and steel-making industry of the Province for the last five years:—

IRON AND STEEL STATISTICS, 1916-1920.

Schedule.	1916	1917	1918	1919	1920
Ontario ore smelted.....short tons	215,366	94,318	99,852	97,514	152,176
Foreign ore smelted..... "	1,056,810	1,221,881	1,400,085	1,201,834	1,341,661
Limestone for flux..... "	296,988	319,535	405,683	343,907	349,960
Coke..... "	708,273	723,657	869,729	736,872	818,698
Charcoal.....bush.	1,843,209	1,288,390	.....	177,795	.....
Pig iron produced.....short tons	699,202	691,233	751,650	623,586	748,173
Value of pig iron produced.....$	9,739,704	14,201,695	20,522,356	16,010,537	21,652,308
Steel made.....short tons	686,959	862,504	881,509	616,251	707,692
Value of Steel made.....$	12,847,309	22,179,982	28,792,361	17,913,263	26,366,524

Ferro-Alloys.—Production in 1920 included 5,496 tons of speigeleisen worth $260,020 by the Algoma Steel Corporation, the bulk of the raw material used being manganiferous iron ore from Minnesota. In addition, a total of 21,171 tons of ferro-silicon worth $1,092,420 were turned out by Electro-Metals, Limited, of Welland; and also to a lesser extent by manufacturers of artificial abrasives from imported bauxite, namely, the Canadian Corundum and National Abrasive companies of Niagara Falls, and the Norton Company at Chippawa.

The Welland plant used 13,367 gross tons of quartzite from its Killarney quarry, 1,159 tons of pyrites ore cinder from the United States and 11,507 tons of steel turnings which came from both United States and Canadian points. This company produced ferro-silicon which has 15, 25 and 50 per cent. non-ferrous content, the bulk of the output being the 15 and 50 per cent. grades.

Coke.—In North America coke has been made for 80 years in beehive ovens and for one-third of that time in by-product ovens. In 1919 the yield of the latter equalled that of the former for the first time. Two great advantages of by-product ovens were emphasised by George Otis Smith, Director of the U.S. Geological Survey, in an address before the American Iron and Steel Institute: (1) The yield of coke in by-product ovens is 23 to 25 per cent. greater with low volatile coals, and 7 to 8 per cent. greater with high volatile Pittsburgh coal: (2) The recovery from each ton of coal of 7 to 15 gals. of tar, benzol, toluol and other oils, 16 to 30 lbs. of sulphate of ammonia and surplus gas constitutes a great conservation of resources.

The Algoma Steel Corporation and the Steel Company of Canada operate respectively 160 and 100 by-product coke ovens, employing 339 men in 1920 and paying wages amounting to $616,250. A total of 1,089,024 short tons of imported coal worth $8,289,388 were used. Of the total blast furnace and foundry coke product mentioned hereunder, 55,727 tons worth $493,715 were sold, the bulk being used in steel-making by the two producing companies. In the latter part of September the Steel Company of Canada commenced operating its new benzol plant. By the end of the year benzol by-products were being produced at the rate of 100,000 U.S. gallons per month from the operations of 100 ovens using 1,250 tons of coal daily.

Coke and coke oven by-products were produced as follows:

Schedule	Quantity	Value $
Coke (Blast Furnace and Foundry).....tons	725,214	8,075,847
Ammonium sulphate.....lbs.	22,622,055	849,935
Tar.....Imp. gals	8,020,936	382,018
Gas.....M. cu. ft.	6,852,191	593,239
Domestic coke.....tons	24,639	62,009
Coke breeze..... "	72,053	94,659
Benzol by-products.....Imp. gl's.	275,015	67,589
Total.....		10,116,296

Lead

The entire output noted in Table I was the product of the Kingdon Mining, Smelting and Manufacturing Company, with mine located at Galetta. There was, in addition, a recovery by United States refineries of 15,661 pounds from the refining of silver ores and gold slag. All the pig produced was consigned to the Jas. Robertson Co., Ltd., plumbing supply manufacturers, with head office in Montreal, Que. Average lead prices for the year were 7.96 and 7.83 cents per pound, respectively, on the New York and St. Louis markets.

NON-METALLIC MINERALS

Actinolite

Actinolite, a fibrous mineral akin to asbestos but of inferior quality, is used chiefly for roofing purposes. There is only one company operating in Ontario, namely: The Actinolite Mining Company, at Actinolite village, where a mill for treating the ore is operated as business demands. The deposits are located in the townships of Elzevir and Kaladar, Hastings county. In 1920 shipments from the mill were 100 tons valued at $1,160. The head office of the company is at Bloomfield, New Jersey.

Barite

Crude barite (barytes or barium sulphate) when ground is used largely for paints and pigments including lithopone (barium sulphate and zinc sulphide), and also to a lesser extent for barium chemicals. Although only one trial shipment of barite was reported in 1920, there are in the Province several important deposits not being worked, principally due to their remoteness from transportation. During 1920 in the United States 228,113 tons of barite were marketed at an average price of $9.39 per ton f.o.b. shipping point, a larger tonnage and higher price than recorded in any previous year. The bulk of the crude ore comes from the States of Missouri and Georgia.

In 1920 on lot 20, Concession X, township of North Burgess, some 7,000 tons of ore were proven and 200 tons, averaging 99.12 per cent. $BaSO_4$, were mined by H. C. Bellew of Montreal, but no shipments were made.

The mill of the Premier Langmuir Mines, Ltd. in Langmuir township, near Porcupine, was not operated, due principally to company reorganization.

The Ravena deposit in Penhorwood township, district of Sudbury, is described by C. H. Hitchcock, mining engineer and geologist for Smith and Travers Company, Limited, Sudbury. The notes which follow are from Mr. Hitchcock's report dated September 30th, 1920:

Ravena.—This barite prospect consists of two mining claims (S. 4419 and S. 4421) in the township of Penhorwood, 3 miles west of Tionaga station on the Canadian National railway and 128½ miles west of Capreol, Ontario. The Barite Syndicate prospected, diamond-drilled and mapped the claims. The railway passes through the property, and the distance from the track to the point where it is proposed to sink a shaft is 2,500 feet. The country is hilly and covered with a forest of pine, spruce, and balsam. Water is plentiful.

The rocks on the claims are mainly pre-Cambrian greenstones. This greenstone is cut by a pegmatite dike which has been pressed and sheared, the ferro-magnesian minerals being largely altered to serpentine. A later fracturing along the strike of the dike made fissures which were filled with barite. The youngest rocks consist of diabase dikes which intrude the pegmatite.

The vein is from one to sixteen feet in width and has been proved by trenches and bore-holes for a length of 1,600 feet and a maximum depth of 130 feet. The impurities in the vein consist of blocks of pegmatite, calcite, quartz and fluorite. The last three minerals are found in or on the walls of the veins or around the blocks of pegmatite that in places occur in the veins. As there is very little intermixed barite, calcite, quartz or fluorite, the conditions are almost ideal for sorting. The barite is not stained with iron oxides and it contains practically no fluorite. The total length and depth of the vein have yet to be ascertained. Diamond-drilling in a sector of the vein 600 feet long and 100 feet deep shows 50,000 tons of barite analyzing 91 per cent. barium sulphate ($BaSO_4$). As the total length of the vein is unknown and as it continues below the 100-foot level, a conservative estimate of the barite available is 75,000 tons.

The work done on the property consists of pits, trenches and six diamond-drill holes, totalling 1,012 feet. There are no buildings, roads or equipment; but the railroad siding has been surveyed to a point suitable for sinking a shaft and for driving an adit level.

Ten channel samples taken on the surface across the width of the vein, which varies from 2 to 11 feet, assayed 94 to 98 per cent. $BaSO_4$, the average being 95.5 per cent.

Forty pounds of material, taken from several different pits after blasting so as to get fresh mineral, were ground to 80-mesh and when analysed gave the following results:

	Mines Branch, Ottawa	Commercial Laboratory.
	Per cent.	Per cent.
Barium sulphate ($BaSO_4$)	97.5	96.45
Silica (SiO_2)	2.28	0.90
Lime (CaO)	Trace	1.14
Magnesia (MgO)	.....	0.12
FeO, Al O	0.0	0.14
Total	99.78	98.75

A trial shipment of 1,200 pounds of barite from various pits where blasting had been done was sent to the St. Joseph Lead Company, 61 Broadway, New York, and was reported to assay: Barium sulphate ($BaSO_4$) 96.14 per cent., and silica (SiO_2) 1.89 per cent.

Boreholes 1, 2, 3 and 5 cut a total of 38.6 feet of vein matter; of this, 29.3 feet was classified as barite and averaged 85.0 per cent. of barium sulphate. As a surface sampling showed 95.5 per cent. of barium sulphate and the core sampling 85.0 per cent., there is a difference of 10.5 per cent. in the two groups of samples. The boreholes may have penetrated impure portions of the veins; or the percentage of barite in the vein may be decreasing with depth and that of calcite increasing. However, the granite, calcite and quartz cored almost perfectly and the barite cored poorly. On the surface calcite weathers more readily than barite; so the true barium sulphate content lies somewhere between the core results of 85.0 and the channel sampling of 95.5 per cent.

The commodity freight rate on barite (crude ore), including the increase of 40 per cent. effective in August, 1920, is approximately one cent. per net ton per mile. The approximate rate to various Canadian points from Kutatush is as follows: Sudbury, $1.50 per net ton; Toronto, $4.05 per net ton; Niagara Falls, $4.88 per net ton; Montreal, Que., $6.00 per net ton.

Power for grinding purposes can be obtained at Sudbury, Ont., for $25.00 per horsepower year.

The following is a list of the more promising mines and prospects:

BARITE MINES AND PROSPECTS

Property	Location.
Barite Syndicate, Sudbury	Penhorwood tp., Sudbury district.
Bellew, H. C., 6 St. Sacrement St., Montreal, Que	Lot 20, Con. X, North Burgess tp.
Caldwell, Thos. B., Lanark	Lavant tp., Lanark Co.
Ontario Barium Co., H. J. Richmond, Sec.-Treas., 33 Victoria St., Toronto	Yarrow tp., Timiskaming district.
Premier Langmuir Mines, Ltd., 40 Bank of Toronto Bldg., London, Ont	Langmuir tp. (Connaught Sta.)
Silk, F. H., 275 St. George St., Toronto	Lawson tp., near Elk Lake.

Celestite

A deposit of this mineral (strontium sulphate, $SrSO_4$) on lot 7, concession X, Bagot township, has been worked by J. E. Wilder, 328 Bleury St., Montreal. In 1918 some 200 tons of ore were mined. In 1920 a trial shipment of 23 tons of ground celestite was made to the Dunlop Tire and Rubber Goods Company, Limited. It was stated that the product was too coarse, a fineness of 350-mesh being required. The paint trade also requires fine grinding. No further development, either in mining or grinding, has taken place.

Feldspar

The market for high potash feldspar in 1920 showed a marked improvement over 1919, owing to an increased demand from the pottery, porcelain and enamelware manufacturers of New Jersey and Ohio. These industries were quiescent during the war period and, owing to their being regarded as non-essential, their fuel supply was curtailed. The year was the most active in this industry on record. Seventeen producers made shipments totalling 37,335 tons valued at $268,295. The industry employed 250 men, their wages totalling $167,165.

During the year a deposit was opened up by W. B. Woods in Chapman township at Cecebe lake, an expansion of the Maganatawan river.

Feldspars, Limited, did not operate its two properties near Verona, where large tonnages are available, but an effort is being made to secure a branch line of railway for facilitating shipments.

The Feldspar Milling Company, Limited, moved its grinding mill from Tichborne to Ashbridge's Bay, Toronto, and commenced grinding at Toronto in November.

FELDSPAR PRODUCERS, 1920.

Name.	Location of Deposit.	P.O. Address.
Dillon and Mills	Lot 23, Con. VI, Monteagle tp.	Hybla.
Eureka Flint & Spar Co., The	Verona	Trenton, N.J.
Federal Feldspar, Limited	Lot 25, Con. III, Bedford tp.	Central Chambers, Ottawa.
Feldspar Milling Co., Ltd	Grinding plant at Toronto	33 Richmond St. W., Toronto.
Feldspar Quarries, Limited	Portland tp	Toronto, 21 Manning Arcade Annex.
Feldspars, Limited	Verona	103 Bay St., Toronto.
Gardner, Wm	Lot 1, Con. I, Loughborough tp.	Hartington.
International Feldspar Co., Ltd.	Godfrey	158 Collingwood Ave., Detroit, Mich.
McConnell Consolidated Mines, Limited	Lot 10, Con. IV, Sherbrooke tp. (Morrow); Lot 3, Con. VII, Bathurst tp. (Kirkham)	Perth.
O'Brien and Fowler	Lots 5 and 8, Cons. II and III, March tp.; Lot 11, Con. IX, Loughborough tp	17 Beech St., Ottawa.
Orser-Kraft Feldspar, Ltd	S. Sherbrooke tp., Feldspar station, C.P. Ry	34 Toronto St., Toronto.
Orser and Wilson	Lot 11, Con. IX, Loughborough tp	Perth Road.
Richardson & Sons, Jas	Lot 16, Con. II, Portland tp.	243 King St., Kingston.
Rock Products Company, The	Lot 10, Con. VI, Bathurst tp.	1154 Nicholas Bldg., Toledo, Ohio.
Universal Silicates, Ltd	Lot 22, Con. VI, Monmouth tp.	Hybla.
Verona Mining Company	Con. VII, Monteagle tp	Hybla.
Woods, W. B. & McColl, John	Lot 26, Con. II, Chapman tp.	Port Carmen.

Fluorspar

The demand for fluorspar has fallen off since the war, when open-hearth steel makers required a large supply. Shipping conditions on the railways have improved, and Ontario spar is not without competition. Careful cobbing is necessary if barite and other objectionable impurities are to be eliminated. Iron and steel makers require a spar carrying at least 80 per cent. of calcium fluoride and free from sulphides, sulphates and phosphates. "Acid" spar should contain not less than 98 per cent. calcium fluoride and not more than 1 per cent. silica. Ground fluorspar containing 92 to 98 per cent. calcium fluoride and 1 to 4 per cent. silica is suitable for the manufacture of opalescent glass, also enamel and sanitary ware.

Ontario's production comes entirely from Madoc in eastern Ontario. Both the Perry mine operated by Cross and Wellington and that of Canadian Industrial Minerals, Limited, the two principal shippers in 1920, were closed at the end of the year owing to lack of a market. Shipments in 1920 totalled 3,704 tons worth $67,381, compared with 3,425 tons in 1919, valued at $60,389, and 7,286 tons worth $153,190 in 1918.

FLUORSPAR PRODUCERS, 1920.

Name.	Location.	Address.
Canadian Industrial Minerals, Ltd.	Huntingdon and Madoc tps.	Toronto, 1511 Bank of Hamilton Bldg.
Cross & Wellington.	Lot 11, Con. XIII, Huntingdon	Madoc.
Wallbridge, G. M.	Lot 1, Con. I, Madoc	Madoc.

Graphite

Graphite mining in Canada is carried on in Ontario and Quebec, all within a radius of 150 miles of the city of Ottawa. The Black Donald mine, situated 12 miles west of Calabogie, in the county of Renfrew, is recognized as the largest and best grade deposit of graphite in America. The mine has been in operation since 1895. The graphite is micro-crystalline in structure, and is associated with metamorphic rocks. For the most part the graphite is fine-grained in which coarse flakes occur in aggregates.

Ontario's output of graphite in 1920 fell off considerably in common with other producing countries, namely: Ceylon, Madagascar and the United States. Crucible manufacture, the main outlet for the product, was inactive in sympathy with the steel trade. To comply with specifications for crucibles graphite must have 90 per cent. graphite carbon, be free from mica and pyrite, and the flake should be retained on an 80-mesh screen. Graphite is also used for lubricants, foundry facings, stove polish, etc. It is the most important solid lubricant, and both the crystalline and amorphous varieties are used for this purpose.

Prior to 1909 dry methods of concentration were employed with large losses. Early in 1919 the Black Donald mine began to use the flotation process with good success and the Spearman flotation process was installed at the Stanleyville plant of the Timmins company. In 1920 the total output of natural graphite in the United States was 9,510 tons, valued at $626,202.

During 1920 the two Ontario companies mentioned hereunder milled 3,787 tons of ore and shipped 288 tons of crude worth $13,066, and 1,668 tons of refined graphite valued at $119,816. There was, in addition, a production of artificial graphite chiefly in the form of electrodes by the Acheson Graphite Company of Niagara Falls, Ontario, totalling 682 tons worth $193,364. As all the raw products, with the exception of sawdust, which enter into the composition of artificial graphite were imported from the United States, the value of the finished products (electrodes and powdered graphite) has not been included in Tables I and II, pages 2 and 3.

GRAPHITE OPERATORS, 1920.

Company.	Location of Mine.	P.O. Address.
Black Donald Graphite Co., Ltd.	Brougham tp., Renfrew county	Calabogie.
Timmins Graphite Mines, The.	N. Burgess tp., Lanark county.	Stanleyville.

Iron Pyrites

With the close of the war the demand for pyrite for sulphuric acid manufacture suddenly slackened, and surplus stocks of acid were still being absorbed in 1920. Although the figures of pyrite shipments for 1920 show an increase over 1919, railway transportation conditions have improved to such an extent that native sulphur from the southern States is now a strong competitor with Ontario pyrite.

The first sulphuric acid plant in Canada was opened at London, Ontario, in 1866, the output being 50 to 60 tons per month, using sulphur from Sicily as the raw product. Its chief use at that time was in oil refining. Subsequently it came into use for the manufacture of muriatic, nitric, phosphoric and acetic acids; in tanning, milk-testing, glycerine and glue production; in treating lead, zinc, cobalt, and nickel ores; in tinning, galvanizing, plating and metal trades; as an electrolyte in storage batteries; paper-making; sulphating alumina and ammonia; acidifying phosphate rock, etc. In fact the use of sulphuric acid is so general in industry that the state of the market for this product may be regarded as a good trade barometer.

The Nichols Chemical Company, with mines at Sulphide, Northpines and Goudreau, is the largest Canadian producer. Shipments from Goudreau of 30 per cent. ore were from stockpile, the mine not having operated during the year. Ore from Northpines carrying forty per cent. sulphur was carried by rail to Fort William docks for shipment by boat. The Grasselli Company at Flower station, and the Canadian Sulphur Ore Company at Queensboro, shipped to the chemical plant at Hamilton belonging to the former company. Shipments to Sault Ste. Marie from stockpile at the Helen mine were made by the Algoma Steel Corporation. Of the total shipments 19,528 tons were consigned to Ontario points and 129,123 tons to the United States.

Following is a list of pyrite shippers in 1920:

IRON PYRITES SHIPPERS, 1920.

Name of Owner, Firm or Company.	Location or Name of Mine.	P.O. Address of Manager, etc.
Algoma Steel Corporation, Limited	Helen	Sault Ste. Marie.
Canadian Sulphur Ore Company, Ltd	Queensboro	Toronto, Crown Office Building.
Grasselli Chemical Co	Caldwell	Flower Station.
Nichols Chemical Co., Limited, The	Goudreau	Goudreau.
	Sulphide	Sulphide.
	Vermillion lake	Northpines.

Mica

Ontario's mica production comes chiefly from the eastern part of the Province. Returns show that sales for the year were 719 tons, worth $54,169. The large tonnage is explained by the inclusion of 427 tons of scrap and dump mica worth $5,683. Shipments were made of 263 tons of rough-cobbed worth $38,177, and 57,049 lbs. of thumb-trimmed. Prices obtained for the last-mentioned variety ranged as follows:

Size.	Price per lb.	Size.	Price per lb.
1″ x 1″	9c. to 15c.	2″ x 4″	60c. to 90c.
1″ x 2″	17c. to 20c.	3″ x 5″	$1.00 to $2.50
1″ x 3″	25c. to 35c.	4″ x 6″	$1.50 to $3.50
2″ x 3″	40c. to 50c.		

The Lacey is the most important deposit. From this mine shipments are made to the General Electric Company at Schenectady, N.Y.

The list of producers is as follows:

MICA PRODUCERS, 1920.

Name of Owner or Producer.	Location or Name of Mine.	P.O. Address of Manager, etc.
Adams, J. H.	N. Burgess tp.	Perth.
Bennett, Herbert V.		Perth.
Cordick, S. J.		Perth.
General Mica Mining Co.	McConkey tp.	Cleveland, Ohio, 9200 Lorain Ave.
Green, George	Bedford tp.	Perth Road.
Kent Bros. and Estate J. M. Stoness	Bedford tp.	Kingston.
Loughborough Mining Co., Ltd	Lacey mine, Loughboro' tp.	Sydenham.
McLaren, W. L.	North Burgess tp.	Perth.
Tory Hill Marble & Mica Co.	Glamorgan tp.	Tory Hill.
H. L. Coombs Co., Ltd	North Elmsley	Perth, R.R. No. 5.

Mineral Waters

For the past few years there has been a slackening demand for mineral waters, due to temperance legislation. It is difficult to secure accurate figures, owing to a large part of the product being shipped in bulk to bottling works. Where bottling is done at the point of production, the value placed upon the sales is much higher than for the bulk article.

Below are tabulated figures since records were first secured in 1918:

Year	Sales		Employees	Wages $
	Imp. Gals.	Value $		
1918	208,498	133,808	45	20,708
1919	276,833	19,290	17	10,228
1920	127,150	15,059	20	10,643

SHIPPERS OF MINERAL WATERS, 1920.

Operator.	Location of Wells or Springs.	Brand of Water.	P.O. Address of Manager, etc.
Allan's, Limited	Caledonia Springs	Caledonia Water	86 Dorchester St. W., Montreal.
Belanger, Arthur	North Plantagenet, George Lake.	St. George	Papineauville, Que.
Borthwick, W	Hawthorne, Gloucester tp	Borthwick	48 Fourth Ave., Ottawa.
Caledonia Springs Co., Ltd., The	Caledonia Springs & Bourget	Magi, Duncan. Adanac	2716 St. Urban St., Montreal.
Canada Mineral Waters, Ltd	Bourget		65 Bellwoods Ave., Toronto.
Carlsbad, Limited, The	Carlsbad Springs	Magi,Carlsbad,Lithia	Carlsbad Springs.
Denault Mineral Water	Bourget		Bourget.
Goderich Mineral Water Co.	Goderich		Goderich.
Gurd & Co., Limited, Charles	Caledonia tp	Gurd's Caledonia Water	76 Bleury St., Montreal.
Sanitaris, Limited	Pakenham tp	Sanitaris	Arnprior.

Natural Gas

A full report, including statistics of production, appears as Part 5, Volume XXX, prepared by the Natural Gas Commissioner. In Table 1, page 2, the production and value are given.

Peat

At the Alfred bog, lots 7-9, con. VIII, Alfred township, Prescott county, experiments were continued by the Peat Committee, appointed jointly by the Provincial and Federal Governments. A report of operations appears on pages 167-170.

During the year 3,900 tons of peat fuel were marketed at $4.00 per ton and 2,000 tons were on hand at the end of the year. Shipments were made to about twenty-five towns and cities, the largest tonnage being consigned to Ottawa.

Petroleum

A report by the Natural Gas Commissioner appears in Vol. XXX, Part 5. Crude petroleum production is given in Table I, page 2.

Quartz and Silica Brick

Production in 1920 includes 4,095 tons of silica brick (1,275,450) by the Algoma Steel Corporation. There was also a shipment of 561 tons of flint pebbles from Santoy near Jackfish on Lake Superior to the Canada Cement Company. Electro-Metals, Limited, of Welland, use the product of their quarry, in the manufacture of ferro-silicon.

Following is a list of quarry operators:

QUARTZ SHIPPERS, 1920.

Name of Owner, Firm or Company.	Location of Quarry.	P.O. Address of Manager, etc.
Electro-Metals, Limited	Killarney	Welland.
International Nickel Company of Canada Limited	Dill tp	Copper Cliff.
McPhail & Wright Construction Co	Bellevue, A. C. Ry	Sault Ste. Marie.
O'Brien and Fowler	March tp	Ottawa.
Todesco, C. W	Santoy	Jackfish.

Salt

Production was well maintained in 1920. Brine was pumped from twenty-six wells. The ten plants operated are all situated in the southwestern peninsula of the Province, between Kincardine on Lake Huron and Amherstburg on the Detroit river. Brine with salt equivalent of 93,712 tons was used in the chemical plant of Brunner Mond, Canada, Limited, at Amherstburg, and that of the Canadian Salt Company, Limited, at Sandwich. Chemicals produced include soda ash by the former company, while the latter turns out caustic soda and bleaching powder.

The following table gives details of Ontario's salt industry over a five-year period:

SALT STATISTICS, 1916—1920.

Schedule	1916	1917	1918	1919	1920
Land tons.	1,050	2,093	2,041	1,720	2,054
Coarse "	29,241	32,236	25,232	35,150	28,709
Fine "	56,325	56,028	53,908	47,571	39,663
Table and Dairy "	30,640	34,251	34,324	34,396	42,474
Brine (salt equivalent)"	11,679	14,301	16,221	29,275	93,712
Total Sales "	128,935	138,909	131,726	148,112	206,612
Value of Sales $	700,515	1,047,707	1,287,039	1,395,368	1,544,867
Employees* No.	238	312	302	296	338
Wages $	208,673	234,925	275,842	319,463	442,004

*Employees of chemical works are not included.

The list of companies producing brine or salt in 1920 was as follows:

SALT COMPANIES, 1920.

Name of Owner, Firm or Company.	Location of Wells or Works.	P.O. Address of Manager, etc.
Brunner, Mond Canada, Limited	Amherstburg*	Amherstburg.
Canadian Salt Company, Limited, The	Windsor	Windsor.
	Sandwich*	
Dominion Salt Company, Limited, The	Sarnia	Sarnia.
Exeter Salt Works Company, Limited	Exeter	Exeter.
Goderich Salt Co., Limited	Goderich	Goderich.
Ontario People's Salt and Soda Co., Ltd.	Kincardine	Kincardine.
Western Canada Flour Mills Co., Ltd.	Goderich	Goderich.
Western Salt Company, Limited	Courtwright	Courtwright.
Wingham Salt Works (Young Estate)	Wingham	Wingham.

*Chemical works using salt brine as raw material.

Talc

During the year three operating companies mined 21,411 tons of crude talc. Shipments included 5,228 tons of crude and 15,131 tons of ground talc, the total being 20,359 tons worth $306,319 as compared with 17,571 tons valued at $240,399 in 1919. In the late fall the Eldorado Mining and Milling Company went out of business, and efforts to secure statistics covering the number of men employed and wages paid were unsuccessful.

Statistics of the industry covering a five-year period are given herewith:

TALC STATISTICS, 1916—1920.

Schedule	1916	1917	1918	1919	1920
Crude talc shipped..... tons.	3,665	2,398	1,044	1,644	5,228
Ground talc shipped..... "	8,145	13,678	16,421	15,927	15,131
Total value shipments..... $	111,489	179,554	246,691	240,339	306,319
Employees, mine and mill..... No.	60	56	43	87	60
Wages paid.....	32,434	49,734	41,936	76,384	77,818

The following companies and firms were engaged in the mining and milling of talc during 1920:

TALC OPERATORS, 1920.

Firm or Company.	Location of Mine or Works.	Address of Manager, etc.
Anglo-American Talc Corporation, Ltd.	Huntingdon tp.	Madoc.
Eldorado Mining and Milling Co., Ltd.	Eldorado	Eldorado.
*Henderson Mines, Limited	Huntingdon tp.	Madoc.
Geo. H. Gillespie and Company, Ltd.	Madoc (grinding mill)	Madoc.

*The Henderson mine was operated under lease by Henderson Mines, Limited, the product going to the mill of Geo. H. Gillespie and Company.

In June, Raymond B. Ladoo, Mineral Technologist of the U.S. Bureau of Mines, paid a visit to Madoc in order to compare methods of mining and milling with practice employed in New York, Vermont and elsewhere in the United States. His investigations were published in September under the title "Talc Mining and Milling at Madoc, Ontario," and reproduced in the November issue of the *Canadian Chemical Journal*.

MATERIALS OF CONSTRUCTION

An idea of the activity in the building trades during 1920 as compared with the ten years preceding may be had from the figures presented in the February, 1921, issue of the Labour Gazette, published by the Department of Labour, Ottawa. Building permits for fifteen Ontario cities in 1920 totalled $47,175,077, as compared with $40,584,834 in 1919, and a maximum of $20,229,574 for any year during the war period. The extraordinary activity shown during the building boom prior to the war reached its peak in 1912, and slackened abruptly in 1915, through the curtailing of all but essentially necessary construction. In 1912 and 1913, the best pre-war years, permits averaged nearly $50,000,000 per year. Increases in valuation in 1920 as in 1919, must be interpreted in the light of increased cost of wages and building materials, although the last two months of the year showed some reduction along these lines. Building permits for twenty-five Ontario cities as reported by the *Labour Gazette* showed a total valuation in 1919 of $46,816,790, and $51,609,700 in 1920. Conditions are still so abnormal that comparison with pre-war years is made difficult.

Clay Products

Brick and Tile.—In the clay-working industries the year was marked by a small decrease in output but increased valuation as compared with 1919. The expected building boom in 1920 did not take place, chiefly due to hesitation on the part of builders who refrained from large scale house construction owing to high costs, unsettled labour conditions and the fear that a general decline in prices might result in heavy losses. There is still a marked shortage of housing accommodation, owing to the inactivity in building operations during the war period. Common brick, which sold at an average price of $7.96 per M. in 1915 at the works, rose to $13.92 per M. in 1919, and to $17.88 per M. in 1920. There has been a decrease in the number of kilns operated, many of the smaller and less efficient plants going out of business. In 1913 there were 199 plants in operation as compared with 106 in 1920. The average period of operation in 1920 was 148 days, and the industry employed 1,793 men whose wages totalled $1,772,194.

TABLE XIII.—OUTPUT AND VALUE OF CLAY PRODUCTS, 1920.

Product	Marketed		Stock on hand Dec. 31, 1920
	Quantity	Value $	
Common Brick ..... M	123,551	2,209,265	M 33,721
Pressed Brick ..... M	21,429	483,627	M 6,620
Tapestry or Rug Brick ..... M	11,130	325,499	M 3,512
Drain Tile ..... M	9,784	359,373	.....
Hollow Building and Roofing Tile ..... tons	58,737	369,530	.....
Pottery	.....	127,049	$12,575
Sewer Pipe	.....	860,811	$243,274

In the following table the value of clay products for the last pre-war year is given and also for each subsequent year:—

TABLE XIV. –VALUE OF CLAY PRODUCTS, 1913-20.

Year	Brick		Pottery	Drain Tile	Sewer Pipe	Total
	Common	Pressed Fancy, Building Tile, etc.				
	$	$	$	$	$	$
1913.....	3,283,894	1,114,410	52.875	292,767	600,297	5,303,181
1914.....	2.336.207	894,381	25,720	277,530	571,756	4,105,597
1915.....	763.591	375,865	49,387	321,253	361,283	1,871,379
1916.....	509,559	495,895	87,025	275,471	216,749	1,584,699
1917.....	713.824	776,302	94,501	546,040	379,923	2,509,590
1918.....	665,454	592,286	88,275	309,899	362,536	2,018,450
1919.....	1.966.711	726,500	119,551	354,700	609,100	3,776,562
1920.....	2,209,265	1,178,656	127,049	359,373	860,811	4,735,154

Average fuel prices as given in the table below show an advance over 1919 figures which were as follows: wood, $6.92 per cord; coal, $6.20 per ton; and natural gas, 22 cents per M. cubic feet:—

FUEL CONSUMPTION, BRICK AND TILE PLANTS, 1920.

Wood			Coal or Coke			Natural Gas		
Cords	Value		Tons	Value		M. c. ft.	Value	
	Total	Average per cord		Total	Average per ton		Total	Average per M
	$	$ c.		$ c.	$ c.		$	$ c.
33,866	252.715	7 46	87,768	968,470	11 03	81,344	21,515	0 26

Following is a list of the brick and tile operators who reported an output in 1920:—

BRICK AND TILE PLANTS, 1920.

Name.	Address.	Product.
Armstrong Bros	Fletcher	Tile.
Baird & Son, H. C	Parkhill	Brick, Tile and Blocks.
Bechtel, B. E	Waterloo	Brick.
Bond & Bird	Woodstock, R.R. No. 5	Common and Pressed Brick.
Booth Brick & Lumber Co., Ltd	Islington, R.R. No. 1	Common and Pressed Brick.
Boyd Pressed Brick Co	Milton	Pressed Brick.
Brampton Pressed Brick Co	Brampton	Pressed Brick.
Broadwell & Son, B	Kingsville	Tile.
Buck, J. L	Port Rowan	Brick, Tile and Blocks.
Bushell, Wm	Toronto, 2 Gillespie Ave.	Brick.
Canadian Pressed Brick Co., Ltd	Hamilton, 36 Sun Life Bldg	Pressed Brick.
Clay Products Co	Detroit, Mich	Brick.
Cooper, W. H	Hamilton, 52 Gage Ave. N	Brick.
Crang, Jethro	Toronto, 202 Oakwood Ave	Brick.
Curtin, Frank	Lindsay	Brick.
De Laplante, J. E. & Co	Toronto, 111 Galt Ave	Brick.
Deller, Albert E	Vienna	Brick, Tile and Blocks.
Deller & Sons, Geo	Norwich, R.R. No. 2	Brick, Tile and Hollow Blocks.
Deller, Wm. H	Thorndale, R.R. No. 4	Tile and Blocks.
Dochart Brick & Tile Works	Arnprior	Brick, Tile and Blocks.
Dolan, John	Watford, R.R. No. 2	Tile.
Dominion Sewer Pipe & Clay Industries, Ltd.	Aldershot and Swansea	Brick.
Don Valley Brick Works	Toronto, 714 Dominion Bank Bldg	Common, Pressed and Tapestry Brick.
Elliott, Charles	Bluevale	Brick and Tile.
Elliott, Wm	Glenannan	Brick and Tile.
Elliott & Sons, Jas	Sault Ste. Marie, 519 Wellington St. N	Brick and Tile.
Erie Clay Products Co	Port Dover	Brick, Tile and Blocks.
Essex Brick Works, Ltd	Detroit, Mich., Room 301, 113 State St	Brick and Tile.
Fox, Geo. J	Dresden	Brick.
Frid Bros	Hamilton	Brick.
Gardiner, William	Blenheim	Brick and Tile.
Godfrey & Co., Thos	Blenheim	Brick and Tile.
Hallatt & Son, H	Comber	Brick and Tile.
Halton Brick Co., Ltd	Terra Cotta	Pressed Brick.
Hamilton Pressed Brick Co., Limited	Hamilton, Kensington Ave. S	Pressed Brick.
Hill, Aaron	Essex	Tile.
Hill, A. W	Coatsworth, R.R. No. 1	Tile.
Hinde Bros	Mount Dennis	Brick.
Hitch, Mrs. Susan	Ridgetown	Brick and Tile.
Hohl, John	Wellesley, R.R. No. 1	Brick and Tile.
Holland & Son, William	Ruscomb	Tile.
Howlett, Fred	Petrolia	Tile.
Interprovincial Brick Co. of Canada, Ltd.,	Toronto, 30 Toronto St.	Pressed Brick.

BRICK AND TILE PLANTS—*Continued.*

Name	Address	Product
Jackson Bros	Brantford	Brick.
Janes, D. A	Mt. Brydges	Brick and Tile.
Jamieson Lime Co	Renfrew	Brick and Tile.
Jeffrey, Leon	Zurich, R.R. No. 2	Brick and Tile.
Jervis & Son, John	Dorchester Station	Brick and Tile.
Koebel, Joseph Z	St. Clements	Brick and Tile.
Kruse Bros	Seaforth, R.R. No. 3	Tile.
Kuhn, Henry J	Centralia, R.R. No. 2	Tile.
Labey & Son, Geo. A	Foxboro'	Tile.
Leamington Brick & Tile Co	Leamington	Brick and Tile.
Lethbridge Brick Co., Ltd	Sault Ste. Marie	Brick.
Lowes, Gordon	Chatham, R.R. No. 3	Brick and Tile.
MacKay Bros	Dutton	Tile.
Martin, David	Thamesville	Tile.
McCormick Bros	Watford, R.R. No. 5	Brick and Tile.
McCredie, W	Belmont, R.R. No. 3	Tile.
McIvor Bros	Cobourg, Box 636	Brick.
McLoughlin, Jno	London, 1044 William St	Brick.
Middleton, Chas	Wyoming	Tile.
Milton Pressed Brick Co., Ltd	Milton	Pressed and Rug Brick.
Miner, J. T	Kingsville, R.R. No. 2	Tile.
Napanee Brick & Tile Co	Napanee	Brick and Tile.
National Fire Proofing Co. of Canada, Ltd	Toronto, 601 Dominion Bank Bldg	Brick, Tile and Blocks.
New, Edward	Hamilton, Dundas Rd	Brick.
Norton, Alsey	Bolton	Tile.
Odell & Sons, Wm	Ingersoll	Brick, Tile and Blocks
Ontario Brick & Tile Plant	Mimico	Brick, Tile and Blocks.
Ontario Paving Brick Co., Limited	West Toronto	Brick.
O'Reilly, T. E	Ottawa, 320 Bay St	Brick.
Ott Brick & Tile Mfg. Co., Limited, The	Kitchener	Brick and Tile.
Ottawa Brick Mfg. Co., Limited, The	Ottawa, 53 Queen St	Brick.
Owen Sound Brick Co., Limited, The	Owen Sound	Brick.
Paxton & Bray	St. Catharines, Queenston St	Brick.
Pears & Son, James	Toronto, Eglinton Ave. W	Brick.
Pembroke Brick Co., The	Pembroke	Brick.
Phillips & Son, Thos	Lucknow, R.R. No. 2	Tile.
Phippen & Field	Toronto, Dawes Road	Brick.
Port Credit Brick Co., Limited, The	Toronto, 307 McKinnon Bldg	Common and Pressed Brick.
Price & Smith	Toronto, 490 Greenwood Ave	Brick.
Price, Ltd., Jno	Toronto, 100 Greenwood Ave	Brick.
Richardson & Son, James	Kerwood	Brick and Tile.
Sarjeant Co., Ltd., The	Orillia	Brick.
Sadler, F. L	Dublin	Brick and Tile.
Shale Brick Co. of Canada, Ltd., The	Cooksville	Brick.
Snelgrove, A	Beaverton	Brick and Tile.
Sproat, Wm. M	Seaforth, R.R. No. 4	Brick and Tile.
Standard Brick Co., Ltd	Toronto, 498 Greenwood Ave	Brick.
Stroh, M. C	Conestogo	Brick and Tile.
Sudbury Brick Co., Ltd	Sudbury	Brick.

BRICK AND TILE PLANTS—*Continued.*

Name	Address	Product
Sun Brick Co.,	Toronto, 32 Toronto St.	Brick and Blocks.
Superior Tile Co., Limited	Fort William	Common and Tapesty Brick.
Toronto Brick Co	Toronto, 60 Victoria St.	Brick.
Wagstaff & Co., A. H	Toronto, 336 Greenwood Ave	Brick.
Waide, J. C	London, 1010 Adelaide St	Brick.
Waite, John E	Forrester Falls	Brick and Tile.]
Wallace & Son, R	North Bay	Brick.
Warwick Brick Works	London, 647 Grosvenor St	Brick.
Winch Bros	Paisley	Brick and Tile.
Windsor Brick & Tile Co	Windsor, 61 Pitt St. E.	Brick. Tile and Blocks.
Woodslee Brick & Tile Co	S. Woodslee	Brick and Tile.
Wright, J. C	Proton	Brick.
Wright & Sons, Geo	Comber	Tile.
Yack, Norman A	Walkerton	Brick and Tile.

Pottery.—Little advance is noticeable in Ontario's pottery trade. At present, production is confined to the rougher grades (flower pots, glazed crockery, etc.) made from domestic (glacial) clays. Fireclays are imported for the manufacture of "stone" ware and refractory linings for stoves. The total value of goods marketed, less the cost of imported clays, was $127,049. The industry employed 46 men whose wages totalled $55,256.

Following are the operators reporting a production in 1920:—

POTTERY MANUFACTURERS, 1920.

Name.	Address.
R. Campbell's Sons	100 Locke St. South, Hamilton.
Davis & Son, John	691 Merton St., Toronto.
Foster Pottery Company	Main St. West., Hamilton.

Sewer Pipe.—The value of marketed products was $860,811, an increase of forty-one per cent. over the 1919 output of $609,100. Production in 1920 was valued at $887,504 and stock on hand at the end of the year $243,274. In 1913, the last pre-war year, the value of the output was $600,297. There are only three companies operating in Ontario as noted below:—

SEWER PIPE WORKS, 1920.

Name of Company.	Location of Plant.	P.O. Address of Manager, etc.
Dominion Sewer Pipe Co., Ltd	Swansea	Swansea.
Hamilton & Toronto Sewer Pipe Co., Ltd	Hamilton	Hamilton.
Ontario Sewer Pipe & Clay Products, Ltd	Mimico	Mimico.

In 1920 the industry employed 264 men, whose wages amounted to $320,880. Fuel consumption was 220 cords of wood and 16,198 tons of coal and coke, the total value being $204,950..

On May 8th, 1920 the Toronto Sewer Pipe Company, Limited, with office at 220 Spadina Avenue, Toronto, received a Provincial charter, the capital being $100,000. This is not a producing company, its business being that of selling agent for the other operators.

Gypsum

In 1920 there was only one operator, the Ontario Gypsum Company, Limited, whose head office is at Paris, Ontario. The two deposits of this company are situated in the valley of the Grand river, townships of Seneca and Oneida, with calcining works at Lythmore and Caledonia. During the year 84,178 tons were mined and milled. Crushed gypsum is used in the Portland cement industry. The calcined product is supplied to manufacturers and roofers, while wall plaster, gypsum blocks and plaster board are used for construction purposes. Crushed, ground and calcined gypsum marketed were 32,025, 153 and 13,185 tons respectively, or a total of 45,963 tons valued at $159,838. In the manufacture of gypsum products 28,744 tons of calcined gypsum worth $244,324 were used. Thus the total sales were $74,707 tons worth $404,162, as compared with 59,899 tons valued at $278,111 in 1919.

In the United States during 1920, gypsum mined exceeded three million tons, the largest production on record, and the total value of crude and calcined gypsum marketed exceeded twenty-four and one-half million dollars, an increase in output of twenty-nine per cent, and in valuation of fifty-six per cent., the latter being due to greater production costs and the rapid increase in the quantity of gypsum board manufactured in recent years.

Portland Cement

Five plants for the manufacture of Portland cement were in operation in 1920, the same number as in 1919. The Canada Cement Company, Limited, has six plants in Ontario, only three of which were operated, while plants No. 6 at Marlbank, No. 9 at Shallow Lake, and No. 7 at Lakefield were idle. The last-mentioned plant was being re-constructed. During the war the capacity of the Hanover plant was increased from 700 to 1,200 barrels per day, and a change-over made from marl to limestone. The National Portland Cement Company of Durham ceased operations in December, 1919, the assets being taken over by the Standard Bank of Canada. The stock on hand (11,258 barrels) was sold during 1920. The Ontario Portland Cement Company, with plant at Blue Lake, near Brantford, went into liquidation in 1919, and was succeeded by the Ontario Cement Company, Limited, which purposes operating at Beachville.

Following is a list of the operating plants:—

PORTLAND CEMENT PLANTS OPERATING IN 1920

Company.	Location of Plant.	Head Office Address.
Canada Cement Company, Ltd.		Herald Bldg., Montreal, Que.
Plant No. 4	Thurlow tp.	
Plant No. 5	Thurlow tp., near Belleville.	
Plant No. 8	Port Colborne.	
Hanover Portland Cement Co., Ltd., The	Hanover	Hanover.
St. Marys Cement Co., Limited	St. Marys	St. Marys.

The capacity of the plants operated during the year was 12,500 barrels per day. An average of 859 men were employed, and wages amounted to $1,283,357.

The following table gives details of the industry in 1913, during the war period and subsequently:—

PORTLAND CEMENT STATISTICS, 1913-1920.

Year	No. of Operating Plants	Stock on hand Dec. 31st bbls.	Sales		Average Price per bbl. $
			Barrels	Value $	
1913	13	450,213	3,802,321	4,105,455	1 08
1914	11	846,562	2,665,650	2,931,190	1 10
1915	7	755,799	2,302,242	2,534,537	1 10
1916	7	380,458	2,143,949	2,242,433	1 05
1917	6	567,261	2,063,231	2,934,271	1 42
1918	4	473,184	1,226,244	1,910,839	1 56
1919	5	278,188	2,022,575	3,659,720	1 81
1920	5	248,142	2,035,594	4,377,814	2 15

Reference was made in the last annual report to the introduction into Canada of "super cement," a new waterproof variety, produced by the introduction of gypsum and a catalytic colloid in the ordinary process of Portland cement manufacture. "Super cement" mortar is claimed to be waterproof, oilproof, and although slower setting, to be eventually stronger than ordinary Portland cement mortar. In 1920 the St. Mary's Cement Company, Limited, manufactured and sold 8,807 barrels of this product for the Canadian Company known as Super Cement (America) Limited, 23 Scott Street, Toronto. The cost to the consumer of this product is about one dollar per barrel more than the price of Portland cement.

The potash recovery plant at the Port Colborne mill of the Canada Cement Company had not reached the producing stage at the close of 1920. Experiments were still being conducted with the object of perfecting the new installation.

Cement Products.—Materials considered in this report are moveable concrete products as distinguished from monolithic concrete construction. Operations for the most part are on a small scale to meet local requirements. Information secured from operators is supplementary to the reports on cement, stone, sand and gravel, and in order to avoid duplication, the statistics of output are not included in the summary (page 2) of mineral production of the Province.

In all the products Portland cement is used as a binder. Brick conform in size and shape to the standard clay product. Architectural concrete stone, including caps and sills, is produced in various shapes and sizes to serve the same purpose as natural cut stone and terra cotta in the facings and trimmings of buildings. Blocks are usually hollow and moulded by hand or machine. Fence posts, silo blocks and staves, and concrete tile for drains, are in common use about the farm. Large sizes of tile are used for culverts and sewer pipe. Owing to the variety of sizes, quantities are given for brick and tile only. In 1920 cement brick to the number of 572,000 and 980,000 tile were produced. As in 1919, the cost of cement ranged high and retarded production considerably.

Detailed statistics for the past five years are given in the tabular statement hereunder:—

CEMENT PRODUCTS STATISTICS, 1916-1920.

Schedule.	1916	1917	1918	1919	1920
Cement brick.....$	10,684	1,420	1,290	10,631	11,117
Cement blocks, sills, caps, etc.....$		8,312	41,362	147,895	382,994
Cement drain tile, culvert tile and sewer pipe.....$	46,946	90,586	81,351	142,072	338,286
Value of total output.....$	57,630	100,318	124,003	300,598	732,397
Average period of operation.....days	109	105	122	108	161
Employees.....No.	73	105	72	148	218
Wages.....$	15,513	28,641	25,901	90,653	212,014

The following list gives the names and addresses of manufacturers of cement products reporting an output during the year:—

MANUFACTURERS OF CEMENT PRODUCTS, 1920.

Name.	Address.	Product
Andrews, S. J.	Clinton	Blocks and Tile.
Art Granite Company	Essex	Blocks and Tile.
Bawden, Frederick W.	Exeter	Blocks.
Beam, P.	Port Colborne	Blocks.
Bowers, E.	Cottam	Blocks and Tile.
Boyd, H.	Osgoode	Blocks and Tile.
Brown, D. L.	Sudbury	Bricks, Blocks and Tile.
Bungalow Brick Company Limited	Toronto, 143 Royce Ave.	Brick.
Burkholder, Geo.	Whitevale	Brick and Tile.

MANUFACTURERS OF CEMENT PRODUCTS—*Continued.*

Name	Address	Product
Canadian Concrete Products Co., Ltd	Chicago, Ill., 521 People's Gas Bldg	Blocks and Tile.
Cast Stone Block & Machine Co	Windsor, 1436 Howard Ave	Brick and Blocks.
Christie, Chas. R	Lindsay, 61 Bond St	Brick, Blocks and Tile.
Concrete Pipe & Products Co., Ltd	Hamilton, York St	Brick, Blocks and Tile.
Clarkson Cement Tile & Brick Co	Clarkson	Brick, Blocks and Tile.
Crewe Bros	Merlin	Blocks.
Cross Builders Supply Co	Windsor, 924 Windsor Ave	Blocks.
Deline, L	Enterprise	Blocks and Tile.
Eldridge, Geo	Sarnia	Blocks.
Elliott, J. A	Dunsford, R.R. No. 1	Blocks.
Fletcher, J. H	Fonthill	Blocks.
Gillies, Alfred	Galt	Brick and Blocks.
Granite Concrete Block Co., Ltd	Mt. Dennis	Blocks.
Hetherington, Isaac	Sheppardton, R.R. No. 1	Tile.
Hewitt & Son, A. B	Princeton, R.R. No. 3	Blocks and Tile.
Independent Concrete Pipe Co	Woodstock	Tile.
Keeler, H	Spencerville	Brick.
Kinzel & Son, Jos	Preston	Blocks and Tile.
Kolbe & Co., W. F	Port Dover	Blocks and Tile.
Oil Springs Tile & Cement Co	Oil Springs	Tile.
Orde, Jno. A	Guelph, R.R. No. 3	Tile.
Osterhout, Peter	Windsor	Blocks and Tile.
Page, Geo. G	Lucknow, R.R. No. 3	Tile.
Peerless Artificial Stone, Ltd	Toronto, Coxwell Ave. and G.T.R. Tracks	Tubs.
Pfaff, W. E	Hensall	Blocks and Tile.
Prast, Frank	Hanover	Blocks and Tile.
Ridgeville Concrete Works	Ridgeville	Brick, Blocks and Tile.
Robinson, Edward	Mitchell, R.R. No. 3	Tile.
Ross, Charles & Son	Dunnville	Tile.
Schram, A. J	Camlachie	Tile.
Showell, P. W	Owen Sound, R.R. No. 6	Blocks and Tile.
Smithson, F	Leamington	Blocks and Tile.
Taylor & Hall	Peterborough	Blocks and Tile.
Watts, Alfred	Tillsonburg	Blocks.
White, Homer & Co	Picton	Brick, Blocks and Tile.
Williams, E. J	Wheatley	Blocks and Tile.

Lime

Production in 1920 shows an increase of over a million bushels, as compared with 1919. Details of the industry for the past four years are given hereunder:—

LIME STATISTICS, 1916-1920

Year	Production						Fuel Cost $	Employees	Wages $
	Hydrated			Total Lime					
	Tons	Total Value $	Per Ton $	Bush.	Value $	Ave. Price per bush. c.			
1917				2,820,507	657,364	23.3		325	262,132
1918				2,650,285	872,177	32.9	237,425	287	300,746
1919	30,454	307,342	10 09	3,991,572	1,268,290	32.4	302,144	363	366,686
1920	28,591	397,305	13,89	4,982,912	1,799,763	36.2	546,604	448	568,513

In 1917 and subsequently, the lime made and used by chemical works such as the American Cyanamid Company; Brunner Mond Canada, Limited (alkali makers) and the Dominion Sugar Company, has been included in statistics of production. In 1920 approximately fifty per cent. of the total output was used in this way. Owing to the increasing use of hydrated lime with cement mortar and concrete, the demand will doubtless increase considerably. The present-day tendency is to produce more hydrated lime, consequently many of the smaller kilns that formerly made quicklime for local use are being abandoned.

Below are given the names of producers and the location of plants operated in 1920:—

LIME PRODUCERS, 1920.

Name of Owner or Company.	Location of Kilns.	Head Office Address.
Alabastine Co., Paris, The (*)	Elora	Paris.
American Cyanamid Co.	Niagara Falls	Niagara Falls.
Beachville White Lime Co., Ltd.	Beachville	Beachville.
Bergin, Patrick	Napanee	Napanee.
Brunner Mond Canada, Limited	Anderdon tp., near Amhertsburg	Toronto, Bank of Commerce Bldg.
Canada Lime Co.	Coboconk	Lindsay, R.R. No. 2.
Chalmers & Campbell	Owen Sound	Owen Sound.
Chesnut, W. D.	Nottawasaga tp.	Duntroon.
Christie, Henderson & Co., Limited (*)	Hespeler, Galt, Puslinch, Kelso	Toronto, 201 Crown Office Bldg.
Delta Lime Co., Limited	Delta	Delta.
Flieler, Edward	Clarendon	Fernleigh.

LIME PRODUCERS —*Continued.*

Name of Owner or Company	Location of Kilns	Head Office Address
Gallagher Lime & Stone Co., Limited	Barton tp	Hamilton.
Gow, James	Melville Junction	Fergus.
Harvey, E., Limited	Rockwood	Guelph
Jamieson Lime Co	Renfrew	Renfrew.
Parks Bros	Beverley tp	Troy.
Robertson Co., D., Limited	Nassagaweya tp	Toronto, 26 Queen St.E.
Smith, John S	Inverhuron	Inverhuron.
Standard Chemical Co., Limited	Eganville	Toronto, 1104 Royal
Standard White Lime Co., Limited (*)	Beachville, Guelph, St. Marys	Bank Bldg. Guelph.
Toronto Brick Co., Limited	Coboconk	Toronto, 60 Victoria St.
Toronto Lime Co., Limited (*)	Dolly Varden	Toronto, 26 Queen St. E.
Toronto Plaster Co., Limited, The (*)	Teeswater	Teeswater.
Weppler, Henry	North Durham tp	Priceville, R.R. No. 2.

*Producers of hydrated lime.

Sand-Lime Brick

Brick are made from sand and lime by compressing these materials in moulds and subjecting the resulting product to a steam bath. These brick will not stand rough handling before they are well cured. They find a ready market, particularly as inside brick, the cost being less than for the clay product.

Six plants operated in 1920, for an average of 221 days. The industry gave employment to 146 men, whose wages totalled $154,592. Coal consumption was 4,579 tons worth $43,223. The yearly capacity of the six plants is 59,888 M. brick. Production in 1920 was 27,656 M. and sales 27,703 M., worth $407,766, or an average of $14.72 per thousand, as compared with $17.88 per M. for common clay brick. Stock on hand at the end of the year was 6,375 M.

The following plants were operated during the year:—

SAND-LIME BRICK PRODUCERS, 1920.

Name.	Location of Plant.	Address.
The Hepworth Silica Pressed Brick Co., Ltd	Hepworth	Hepworth.
The Schultz Bros. Co., Ltd	McMurray St., Brantford	49 Albion St., Brantford.
Toronto Brick Co., Limited	Scarboro and Swansea	60 Victoria St., Toronto.
Willcox Lake Brick Co., Ltd	Whitechurch tp	Richmond Hill.
York Sandstone Brick Co., Ltd	Gerrard St. and Victoria Ave., E. Toronto.	Toronto, 142 Annette St.

Sand and Gravel

During 1920 sand and gravel removed from pits and beaches totalled 697,474 cubic yards, and by dredging and sand-sucking operations 1,464,767 cubic yards. These figures do not include materials used for railway ballast, of which no record is kept.

Under authority of the Public Lands Act, and the Beach Protection Amendment Act, 1920, licenses are issued by the Ontario Government for the removal of sand, gravel and stone from the beds of the Great Lakes and other navigable waters. In addition to license fees and rentals of $2,803, royalties amounting to $96,850, or an average of 14 cents per cubic yard were paid in 1920 on 690,371 cubic yards of sand and gravel dredged. No royalty is collected on some of this material, more particularly water lots in the vicinity of Point Pelee in Lake Erie which are privately owned.

Self-loading boats dredging gravel below tunnel, St. Clair river.

Vessel leaving dredge after being loaded, St Clair river

SAND AND GRAVEL STATISTICS, 1920.

Source	Sand		Gravel		Employees	Wages
	cu. yds	Value $	cu. yds.	Value $		$
Pits and Beaches	385,874	392,550	311,600	167,270	172	199,888
Great Lakes and Rivers	179,047	70,272	1,285,720	760,612	448	306,268
Total	564,921	462,822	1,597,320	927,882	620	506,156

Following is a list of sand and gravel pit operators who marketed or used 1,000 cubic yards or more during the year:—

SAND AND GRAVEL OPERATORS, 1920.

Name of Owner or Company	Material G—Gravel S—Sand	Location of Deposits	Address
Aldborough, Township of	G.	Aldborough tp., lot A, con. 7	Rodney.
Armstrong Supply Co., Ltd., The	S.	1143 York St., Hamilton	34James St. N., Hamilton
Baxter, Jas	G.	Dereham tp., lot 17, con. X	Brownsville, R.R. No. 1.
Bellyou, Norman E	S. and G.	Murray tp., lot 6, con. 1	Trenton, R.R. No. 4.
Benson & Patterson	S. and G.	Stamford tp	Stamford.
Canadian Steel Corp'n, Ltd	S.	Ojibway	Ojibway.
Constructing & Paving Co. of Ont. Ltd	S. and G.	Erie tp	Toronto, 708 Confederation Life Bldg.
Downey, I. J. & Sons	G.	Garden River	Sault Ste. Marie.
Ellins Sand & Gravel Co	S. and G.	Sherkston	219Scarlett Rd., Toronto
Empire Limestone Co	S.	Humberstone tp	Buffalo, N.Y., 19 Hudson St.
Godson Contracting Co., Ltd	S. and G.	Brock tp., lot 12, con. IV	Toronto, 113 Manning Chambers.
Hamilton, Joseph C	S. and G.	Stafford tp	Pembroke.
Hamilton Sand & Gravel, Ltd	S. and G.	Burlington Heights	Hamilton, 110 Queen St. N.
Homer White & Co	S. and G.		Spring St., Picton.
Hydro-Electric Power Commission	S.	Stamford	Box 245, Niagara Falls.
Kerr, Estate of John	G.	Enniskillen tp	Petrolia.
Kilbourne & Son, Harvey	S.	Westminster tp., Wharncliffe Rd	London, 9 Cove Road.
Kingston Sand & Gravel Co	S.	Kingston tp	Kingston, R.R. No. 5.
Larter, Chas	S. and G.	Waterloo tp., N. of Galt	Galt, 76 Chambers St.
Lyons Fuel & Supply Co	G.	Mile 34, A.C.Ry	Sault Ste. Marie, Ont.
Maple Sand, Gravel & Brick Co	S. and G.	Vaughan tp., lots 21-24 con. III	Toronto, 484 King St. W.
McPhail & Wright Construction Co.	S.	Korah tp	Sault Ste. Marie.
Neville & Son, Thos	S. and G.	Malahide tp., lot 7, con. 5	Aylmer, R.R. No. 5.
Oakland Sand & Gravel Co	S. and G.	Oakland tp	Niagara Falls.
Ontario Highways Dept	S. and G.		Parliament Buildings, Toronto.
Paris Sand & Gravel Co	S. and G.	Dumfries tp., lot 30, con. I	Paris, R.R. No. 2....
Ponsford, A. E	S. and G.	Yarmouth tp., lot 1, con. VIII	St. Thomas, 605 Talbot St.
Sand & Supplies, Ltd	S. and G.	Dumfries tp., lot 30, con. IX	Toronto, 19 Melinda St.
Superior Sand & Gravel Co	G.	Point Edwards	Detroit, Mich., 926 Dime Bank Bldg.
Windsor, Essex & Lake Shore Ry. Co	G.	Mersea tp., W. of Leamington	Kingsville.
Windsor Sand & Gravel Co., Ltd., The	S. and G.	Two miles west of Leamington	Windsor, 57 Hall Ave.
York Sand & Gravel Co., Ltd	S. and G.	Gerrard St. E. and Victoria Park Ave.	Toronto, 1327 Bloor St. W.

The following carried on dredging operations under license:

SAND AND GRAVEL LICENSES, 1920.

Name of Company.	Material. G—Gravel. S—Sand.	Location of Deposit.	Address.
Cadwell Dredging Co., Ltd.	G.	Lake Erie, off Point Pelee	Windsor.
Chatham Sand & Gravel Co.	S. and G.	Thames River	Chatham.
Chick Contracting Co.	G.	St. Clair River	Windsor.
Cameron Steamship Co.	G.	St. Clair River	Detroit, 39 Buhl Bldg.
Department of Railways & Canals.	G.	Niagara River	Ottawa.
Great Lakes Transportation Co.	S.	Lake Superior	Fort William.
Hadley Co., Ltd., The C. & J.	S. and G.	Thames River	Chatham.
Homegardner Sand Co.	S.	Dummy Foundation, Lake Erie	Sandusky, Ohio.
International Sand & Gravel Co.	G.	St. Clair River	Detroit, 47 Campau Bldg.
Lake Erie Sand Co.	S.	Dummy Foundation, Lake Erie	Sandusky, Ohio.
Marysville Land Co.	G.	St. Clair River	Marysville, Mich.
McLean & Son, A. B.	G.	Head of St. Marys River	Sault Ste. Marie.
National Sand & Material Co.	S. and G.	Lakes Erie and Ontario	Welland.
Niagara Sand Co.	S.	Niagara River	Toronto, 408 Lumsden Bldg.
Niagara Sand Corporation	G.	Niagara River	Buffalo, N.Y., 907 White Bldg.
Ontario Gravel Freighting Co.	G.	St. Clair River	Windsor.
Port Huron Sand & Gravel Co.	G.	St. Clair River	Port Yuron, 801 Water St.
Superior Sand & Gravel Co.	G.	St. Clair River	Detroit, 925 Dime Bank Bldg.
United Fuel & Supply Co.	G.	St. Clair River	Detroit, Fress Press Bldg.

Stone

As indicated in the accompanying table the output of stone in 1920 shows a marked increase over preceding years, particularly as regards limestone and granite. The industry afforded employment to 961 men, whose wages totalled $1,037,832. Producers of limestone whose output was in excess of $100,000 in value are given in order: Hydro-Electric Power Commission, Canada Crushed Stone Corporation, Point Anne Quarries, Department of Highways, Brunner Mond, and the Michigan Central Railway. The first-mentioned used stone valued at over one million dollars in connection with the Chippawa power development scheme. Trap rock was used extensively in Toronto harbour improvements, while granite was in demand for paving purposes.

Following are the names of quarry operators reporting a production for 1920, classified according to product:—

STONE QUARRIES, 1920.

Name of Owner, Firm or Company.	Location	Kind of Stone.
Aybrams, J. M.	Gananoque	Limestone.
Ball & Sons, Henry C.	Granthan tp	Limestone.
Bancroft Marble Quarries, Limited	Dungannon Tp	Marble.
Beachville White Lime Co.	Beachville	Limestone.
Bergin, Patrick	Napanee	Limestone.
Bolender Bros	Haliburton	Crystalline Limestone.
Bourgie, J. B.	Russell tp	Limestone.
Britnell & Co., Ltd	Somerville	Limestone.
Britnell & Co., Ltd	Toronto	Limestone.
Brown, A. C.	Leeds tp	Granite.
Brown, Robert	Lyndhurst	Granite.
Bruce Mines Trap Rock Co., Limited	Bruce Mines	Trap.
Brunner, Mond Canada, Ltd	Amherstburg	Limestone.
Canada Crushed Stone Corporation, Limited.	Dundas	Limestone.
Cayuga Stone Co.	N. Cayuga tp	Limestone.
Contractors' Supply Co., Limited	Toronto	Crushed Limestone.
Cook, J. S. & Son	Wiarton	Limestone.
Crookston Quarries, Ltd.	Crookston	Limestone.
Crushed Stone, Limited	Kirkfield	Crushed Limestone.
Department of Highways		Limestone.
Farr, Mrs. L. G.	Haileybury	Limestone.
Fort William, Corp'n. of the City of	Indian Reserve	Trap.
Granite Crushed & Dimension, Ltd.	Toronto	Granite.
Gallagher Lime & Stone Co.	Hamilton	Limestone.
Gordon Granite Co., D. J.	Gananoque	Granite Blocks, etc.
Hagersville Contracting Co.	Dundas	Limestone.
Hagersville Crushed Stone Co., Limited.	Hagersville	Limestone.
Hagersville Quarries	Walpole tp	Limestone.
Haldimand County Good Roads System	Nelles Cor. & Dunnville	Limestone
Hamilton, Corporation of	Hamilton	Limestone.
Higginson, Geo. & Son	Coldwater	Limestone.
Horne, Wm.	Ignace and Butler	Granite.
Hydro-Electric Power Commission	Queenston	Limestone.
Jamieson Lime Co.	Renfrew	Limestone.
Kingston Penitentiary Quarries	Portsmouth	Limestone.
Lincoln County	N. Grimsby tp	Limestone.
Longford Quarry Co., Limited	Longford Mills	Limestone and Riprap.
Markus, Wm. Ltd.	Pembroke	Limestone.
Michigan Central Railway Co.	Hagersville	Limestone.
Middleton, John N.	Ancaster	Limestone.
Mond Nickel Co., Ltd.		Trap.
Oliver-Rogers Stone Co., Limited, The	Owen Sound	Trap.
Ontario Rock Co., Ltd.	Toronto	Trap.
Ontario Stone Corporation, Limited	Uhthoff	Limestone.
Perkins, Geo. A.	Owen Sound	Limestone.
Point Anne Quarries, Limited	Point Anne	Limestone.
Prescott, Corporation of	Prescott	Limestone.
Queenston Quarry Co., Limited	St. David	Limestone.
Quinlan & Robertson, Ltd.	Crookston	Limestone.
Robillard, H.	Gloucester tp	Limestone.
Reid, C. F.	Odessa	Limestone.
Rideau Canal Supply Co., Limited	Ottawa	Limestone.
Robertson, D., Co.	Nassagaweya	Sandstone.
Robertson, D., & Company, Limited.	Milton	Sandstone.
Robillard, H., & Son	Ottawa	Limestone.
Roddy & Monk	Kingston	Limestone.
Rogers & Co., F.	Toronto	Sandstone.
Standard White Lime Co., Limited	Beachville, Guelph and St. Marys	Limestone.
Street & O'Brien	Gananoque	Granite.
Thames Quarry Co.	St. Marys	Limestone.
Walker Bros.	Thorold	Limestone.
Wentworth Quarry Co., Limited	Vinemount	Limestone.
Whitney, Geo., & C. W.	Terra Cotta	Sandstone.
Wilson, Geo. S.	Perth, R.R. No. 3	Sandstone.

The tonnages of limestone and trap marketed were 2,859,245 and 81,262 respectively. Details for a five-year period are given in the following table:

TABLE XV.—VALUE OF STONE PRODUCTION, 1916-1920.

Year	Limestone	Sandstone	Trap	Granite	Marble	Total
	$	$	$	$	$	$
1916	625,628	14,238	91,762	23,655		755,313
1917	728,975	115,932	70,570	25,575		941,052
1918	820,985	145	24,744	23,334		869,238
1919	1,112,340	5,544	82,995	10,683	19,360	1,230,922
1920	3,786,263	10,592	92,630	55,277	300	3,944,972

Mining Divisions

The mineral areas of the Province are comprised in twelve Mining Divisions. The official in charge of a Mining Division is termed a Mining Recorder, and he administers the Crown lands within his Division for the purposes of the Mining Act. He issues miners' licenses, receives and records applications for mining claims, settles disputes between licensees, and performs a variety of other duties laid down for him in the Act. There is an appeal from his decisions to the Mining Commissioner, who is clothed with judicial powers with respect to mining lands. Once the Crown title has issued, any subsequent controversy is referred to the ordinary courts of law. This decentralized system has proven of much advantage, being local in administration, flexible in operation, and enabling speedy and inexpensive settlement to be made of disputes concerning mining lands, which are bound to arise under any conceivable mining law.

At the end of the year the Recorders report to the Department regarding the work of their respective offices, and comment upon the state of the mining industry in their Divisions. Although there are thirteen Mining Divisions, there are only nine Mining Recorders, a single Recorder being in three cases in charge of two Divisions, where the amount of business or local convenience indicates the advisability of such an arrangement. Where mining claims are staked in those parts of the Province not included in a Mining Division, the Department of Mines at Toronto acts as Recorder, also in one Division for which there is no resident Recorder. During 1920, at Toronto, 307 miners' licenses and 467 renewals were issued.

Following is a summary of the reports of the Mining Recorders:—

Sudbury.—About the first of the year there was considerable activity in West Shiningtree, owing principally to the fact that some of the companies were doing development work. Some staking was done for gold in the township of Marshay, and the holders of these claims are going ahead with the assessment work.

Porcupine.—There have not been many new discoveries or developments in this camp during the past year, which was a poor year for prospecting on account of the high cost of labor and materials and the state of the financial market. The output of the producing mines in the camp last year was the largest in its history, and 1921 promises to be a banner year. Labor conditions have so improved that the mines will be able to produce to capacity for the first time in several years, and there is a noticeable reduction in the cost of material and supplies. It is anticipated that, as a result, prospecting will be considerably stimulated.

Sault Ste. Marie.—Business improved, mainly through the activity of the prospectors along the line of the Algoma Central railway. About 180 claims were staked and recorded in the Goudreau section, some of which have been patented. The O'Brien interests of Cobalt have secured an option on the McCarthy-Webb gold claims in that camp.

Port Arthur.—Interest centred in the nickel deposits near the western extremity of Lower Lake Shebandowan, and the area near Schreiber where gold has been found on the Longworth property, about two and a half miles south of the town, and also on W. S. Jackson's claim about two miles east of Schreiber. The reduced charge for filing claims materially lessened the receipts.

Kowkash.—The year 1920 has not shown much activity in the Kowkash Division.

Parry Sound.—This office was closed on November 1st, 1920, and all records of the Division were transferred to the Department at Toronto.

Gowganda.—Over 200 mining claims were recorded and considerable development work was performed on these new claims. Several rich discoveries of silver were reported during the summer.

Montreal River.—Forest fires in this Division during the most opportune time for prospectors to visit their claims, greatly hindered both prospecting and development. Matachewan no doubt will be attractive to the prospector as soon as mining operations commence on the Otisse and Davidson claims.

The two tables following show the work done in the offices of the Mining Recorders during 1920, the first table being for the fiscal year ending October 31, and the second for the calendar year.

MONEYS REMITTED BY MINING RECORDERS FOR THE FISCAL YEAR ENDING OCTOBER 31, 1920

Mining Division	Name of Recorder	Address	Purchase Price	Permits	Miners' Licenses	Recording fees, etc.	Total
			$ c.	$ c.	$ c.	$ c.	$ c.
Sudbury	Campbell, C. A.	Sudbury	3,580 66	470 00	2,936 00	3,272 00	10,258 66
Porcupine	Donaghue, W. A.	S. Porcupine	5,664 17	91 00	1,676 00	1,950 25	9,381 42
Larder Lake	Ginn, H. G.	Swastika	19,010 91		1,998 00	9,648 60	30,657 51
Sault Ste. Marie	Miller, W. N.	Sault Ste. Marie	1,526 98	50 00	1,124 00	774 50	3,475 48
Port Arthur, Kowkash	Morgan, J. W.	Port Arthur	2,791 10	30 00	1,806 00	1,456 00	6,083 10
Timiskaming	McAulay, N. J.	Haileybury	1,668 58	150 00	5,630 00	3,217 75	10,666 33
Parry Sound, Gowganda, Montreal River	McQuire, H. F.	Parry Sound	300 00		679 00	503 00	1,482 00
	Morgan, M. R.	Elk Lake	1,739 90	590 00	1,216 25	4,308 00	7,854 15
Kenora	O'Flaherty, T. F.	Kenora	1,109 30		324 00	280 65	1,713 95
Total			37,391 60	1,381 00	17,389 25	25,410 75	81,572 60

SUMMARY OF BUSINESS IN THE SEVERAL MINING DIVISIONS FOR THE CALENDAR YEAR, 1920.

	Sudbury	Porcupine	Larder Lake	S. S. Marie	Pt. Arthur	Kowkash	Timiskaming & Coleman	Parry Sound	Gowganda	Montreal River	Kenora	Total
1. Letters received	1,664	1,859	5,100	615	2,308	488	1,592	.....	1,267	2,447	1,115	18,455
2. Letters written	1,328	1,817	4,680	381	2,197	413	1,134	.....	1,055	2,029	1,152	16,186
3. Miners' Licenses issued	246	120	131	113	111	5	280	46	28	40	34	1,154
4. Miners' Licenses renewed	364	238	295	121	229	26	869	71	49	124	30	2,416
5. Mining applications recorded	267	192	712	90	108	21	329	33	215	81	25	2,073
6. Mining applications cancelled	465	330	385	45	241	22	387	13	108	169	38	2,203
7. Agreements, Transfers, etc., recorded	180	102	569	29	27	9	161	5	74	83	6	1,245
8. Amount received for Miners' Licenses, Permits, Recording Fees, etc.	$6,503 55	$3,777 00	$10,912 55	$1,930 50	$2,927 25	$418 75	$8,599 50	$828 00	$2,856 00	$2,401 50	$302 50	$41,457 10
9. Amount received as Purchase Money or Rental	$2,357 47	$6,539 84	$20,410 41	$2,193 72	$2,932 95	$179 55	$1,102 94	$300 00	$854 77	$1,028 48	$491 05	$38,391 18
10. Claims of which surveyors' plans were filed	49	33	303	56	43	4	13	.....	24	10	1	536
11. Disputes entered	.....	1	11	1	.....	.....	2	.....	.....	.....	.....	15
12. Disputed cases decided by Recorder	.....	.....	6	.....	.....	.....	.....	.....	.....	.....	.....	6
13. Appeals to Mining Commissioner	.....	1	.....	.....	.....	.....	3	.....	.....	.....	4	8
14. Extensions of time	124	98	492	2	89	24	37	15	94	103	7	1,085
15. Certificates of Record	39	71	280	13	48	7	18	6	24	18	1	525
16. Certificates of Performance of Work	41	69	325	21	43	5	16	3	25	16	6	570
17. Claims for which papers were forwarded to the Department for issue of title	36	64	203	22	46	4	18	2	22	14	5	436
18. Forest Reserve Permits issued	49	.....	.....	6	5	1	15	.....	9	44	.....	129
19. Substitute Miners' Licenses issued	.....	.....	2	1	.....	.....	13	2	.....	1	.....	19

Mining companies incorporated under the Ontario Companies Act in 1920 are shown in the list appended, together with their respective head offices, date of incorporation and amount of capital authorized.

MINING COMPANIES INCORPORATED IN 1920

Name of Company	Head Office	Date of Incorporation	Capital $
Ajax Oil and Gas Company, Limited	Toronto	April 22	500,000
Algomont Mines, Limited	Toronto	Mar. 12	4,000,000
Alkyris Mines, Limited	Goderich	June 25	1,000,000
Allied Oil, Limited	Toronto	Jan. 17	250,000
Alliston Gold Mines, Limited	Alliston	Sept. 11	1,000,000
Alpine Silver Mines, Limited	Niagara Falls	Sept. 20	2,000,000
Bailey Silver Mines, Limited	Toronto	Feb. 3	1,250,000
Barry-Webster Gold Mines, Limited	Haileybury	July 29	2,000,000
Beaver Nickel Company, Limited	Fort William	July 10	300,000
Biemark Oil Company, Limited	Toronto	Jan. 30	1,000,000
Big Win Oil and Gas Company, Limited	Toronto	Dec. 23	500,000
Border Cities Oil and Gas Company, Limited	Windsor	May 6	100,000
Bousquet Gold Mines, Limited	Toronto	Nov. 1	2,000,000
Brantford Sand and Gravel Company, Limited	Brantford	July 5	100,000
Brigden Brick and Tile Company, Limited	Brigden	April 6	40,000
British Talc and Mineral, Limited	Toronto	Oct. 15	200,000
Canadian Associated Goldfields, Limited	Toronto	Aug. 7	30,000,000
Canadian Casey Cobalt Company, Limited	Toronto	Sept. 2	245,000
Canadian Clay Company, Limited	Toronto	May 20	500,000
Cardiff Molybdenite Mines, Limited	Toronto	Jan. 16	40,000
Challenger Gold Mining Company, Limited	Toronto	Aug. 27	110,000
Clover Gas and Oil Company, Limited	Fort Erie	Dec. 10	100,000
Concrete Brick Company of Canada, Limited	Windsor	April 1	40,000
Conroy-McAndrew Silver Mining Co., Limited	Toronto	Feb. 18	100,000
Deloro Chemical Company, Limited	Deloro	Sept. 27	500,000
Diamond Oil, Limited	Glencoe	Nov. 29	1,000,000
Don Valley Brick Works, Limited	Toronto	Sept. 20	1,000,000
Eagle Oil and Gas Company, Limited	Toronto	Aug. 9	500,000
Erie Clay Products, Limited	Port Dover	Dec. 8	80,000
Essex Brick Works, Limited	Essex	May 31	25,000
Eureka Oil and Gas Company, Limited	Toronto	Mar. 19	500,000
Federal Feldspar, Limited	Toronto	Mar. 5	40,000
Frame Porcupine Mines, Limited	Toronto	Jan. 15	1,500,000
Gibson Gold Mines, Limited	Toronto	Feb. 6	1,000,000
Graphite Oils, Limited	Toronto	Jan. 10	500,000
Great Kirkland Gold Mines, Limited	Toronto	Nov. 12	1,500,000
Hagersville Quarries, Limited	St. Thomas	Nov. 22	100,000
Harvey-Kirkland Gold Mines, Limited	Toronto	May 1	1,500,000
Height of Land Mining Syndicate, Limited	Toronto	July 23	50,000
Highland-Kirkland Mines, Limited	New Liskeard	Oct. 25	100,000
Indian Peninsula Molybdenum Co., Limited	Toronto	Nov. 15	1,000,000
Iroquois-Kirkland Mines Corporation, Limited	Toronto	July 2	2,000,000
King Kirkland Gold Mines, Limited	Toronto	Mar. 2	2,500,000
Kitchener Kirkland Mines, Limited	Kitchener	Mar. 4	3,000,000
Kitchener Oil Company, Limited	Kitchener	Oct. 30	40,000
Kyto Oil and Gas Company, Limited	Windsor	July 2	99,000
Lafayette Silver Mines, Limited	Toronto	April 20	750,000
Lebel Crystal Lake Gold Mines, Limited	Kirkland Lake	Jan. 5	3,000,000
Lebel Oro Mines, Limited	Toronto	April 21	1,500,000
Lightning River Gold Mines, Limited	Cobalt	Feb. 17	3,000,000
Mackenzie River Oil Limited	Toronto	Nov. 12	5,000,000
Manitoulin Oil Company, Limited	Toronto	Oct. 1	1,000,000
Miller Lake Silver Star Mines, Limited	Gowganda	Mar. 20	2,000,000
Moffat-Hall Gold Mines, Limited	Haileybury	Feb. 23	3,000,000
Murray Townsite Mines, Limited	Sudbury	July 3	120,000
Muskoka Quarries, Limited	Toronto	April 27	300,000
New Harris Mines, Limited	Toronto	April 7	40,000
Niagara Sand Company, Limited	Toronto	June 11	250,000
North American Feldspar, Limited	Toronto	Sept. 7	60,000
Northcrown Porcupine Mines, Limited	Toronto	April 8	3,000,000
Northern Customs Mines, Limited	Toronto	Jan. 23	1,000,000
Northern Extension Cobalt Mines, Limited	Toronto	May 11	100,000
Northland Gold Mines, Limited	Haileybury	Jan. 31	2,000,000

MINING COMPANIES INCORPORATED IN 1920.—*Continued.*

Name of Company	Head Office	Date of Incorporation	Capital $
Ontario Bricklaying Company, Limited	Toronto	Dec. 22	40,000
Ontario Production Company, Limited	Toronto	July 8	600,000
Ontario Smelters and Refiners, Limited	Chippawa	Jan. 5	750,000
Ontario Western Petroleum, Limited	Windermere	Dec. 6	500,000
Opeongo Mica Mines, Limited	Renfrew	Jan. 27	500,000
Orser-Kraft Feldspar, Limited	Perth	May 7	100,000
Penly-Cobalt Exploration Company, Limited	Toronto	July 16	50,000
Penn-Canada Fire Brick Company, Limited	Toronto	Oct. 23	40,000
Peoples' Oil and Gas, Limited	Chatham	Sept. 29	1,000,000
Pinelle Kirkland Mines, Limited	Toronto	Feb. 26	4,000,000
Primo Silver-Cobalt Mining Company, Limited	Toronto	Nov. 18	1,000,000
Progressive Gold Mines, Limited	Toronto	July 6	2,000,000
Ruby Operative Cobalt Mines, Limited	Cobalt	Dec. 10	1,500,000
Sarnia Cement Products, Limited	Point Edward	Oct. 25	100,000
Sesekinika Divide Mines, Limited	Toronto	Dec. 14	3,000,000
Silbar Cobalt Mines, Limited	Toronto	Mar. 6	1,500,000
Silverado Extension, Limited	Toronto	Feb. 3	1,500,000
South West Porcupine Syndicate, Limited	Toronto	July 30	100,000
Superior Oil Company, Limited	Toronto	July 6	100,000
Tar Island Oil and Gas Company, Limited	Toronto	April 19	1,500,000
Thames Oil and Gas Company, Limited	Toronto	June 25	500,000
The Blue Mountain Oil and Gas Co., Limited	Toronto	Aug. 25	40,000
The Brant-Keora Mining Company, Limited	Toronto	July 28	2,000,000
The Casey Mountain Operating Syndicate, Ltd.	Toronto	Dec. 6	100,000
The Central Canada Oil Company, Limited	Toronto	Feb. 12	500,000
The Doran Oil and Gas Company, Limited	Meaford	Sept. 2	100,000
The Herman Exploration and Development Company, Limited	South Porcupine	Feb. 19	25,000
The Independent Oil Company of Adelaide., Ltd.	Adelaide	April 6	40,000
The International Prospecting and Developing Company, Limited	Ottawa	Mar. 10	1,000,000
The Kingston Smelting and Refining Company, Limited	Kingston	June 2	1,000,000
The Ontario and Peace River Oil and Gas Producing Company, Limited	Toronto	May 6	2,500,000
The Ontario Cement Company, Limited	Brantford	Feb. 19	1,000,000
The Petrol Oil and Gas Company, Limited	Toronto	May 12	1,000,000
The Regent Mines, Limited	Sarnia	July 2	1,000,000
The Sarnia Oil and Gas Company, Limited	Sarnia	Nov. 11	500,000
Thesaurus Gold Mines, Limited	Toronto	Jan. 6	1,000,000
The Silica Granite Products Company, Limited	Hamilton	Oct. 8	200,000
The Springvale Gas and Oil Company, Limited	Hagersville	Dec. 10	100,000
The Trinidad Oil Producing and Refining Company (of Canada), Limited	Toronto	April 29	150,000
The Victory Oil and Gas Company, Limited	Toronto	June 21	500,000
The Western Oil Company, Limited	St. Catharines	Dec. 8	500,000
The West Williams Oil and Gas Co., Limited	Parkhill	Aug. 27	40,000
Toronto-Great Lakes Oils, Limited	Toronto	Jan. 9	200,000
Toronto Oil Company, Limited	Toronto	Nov. 12	1,000,000
Trans-Canada Explorers, Limited	Toronto	May 6	200,000
Trans-Canadian Oil Company, Limited	Aylmer	April 6	5,000,000
Turnbull Mines of Porcupine, Limited	Toronto	Dec. 18	2,000,000
Union Exploration Company, Limited	Chatham	Oct. 1	1,000,000
Union Mining Corporation, Limited	Toronto	Feb. 13	1,000,000
Universal Gas and Oil, Limited	Toronto	Aug. 12	1,500,000
Valley Oil and Gas Company, Limited	Hamilton	Sept. 13	100,000
Victory Silver Mines, Limited	St. Catharines	May 20	2,000,000
Wasapika Consolidated Mines, Limited	Toronto	Jan. 16	6,000,000
Western Counties Gas Company, Limited	Toronto	Mar. 5	250,000
Whitney-Porcupine Gold Mines, Limited	Haileybury	June 21	40,000
York Brick and Building Company, Limited	Toronto	May 29	100,000
Total (119 Companies)			146,094,000

Companies of Extra-Provincial incorporation holding mining lands in Ontario are required under The Ontario Companies Act to take out a license and specify the amount of capital used in Ontario in connection with mining.

Following is a list of the companies so licensed in 1920:

MINING COMPANIES LICENSED IN 1920.

Name of Company	Head Office for Ontario	Date of License	Capital for use in Ontario
			$
Argonaut Gold, Limited	Dane	Dec. 6	1,000,000
Brunner Mond Canada, Limited	Toronto	Nov. 23	5,000,000
Chippewa Petroleum Corporation	Hamilton	Mar. 23	40,000
Coke Oven Company of Canada, Limited	Hamilton	May 4	5,000
Inter-Provincial Brick Company of Canada, Limited	Toronto	Nov. 4	500,000
Keeley Silver Mines, Limited	Almonte	July 27	600,000
Kirkland Lake Proprietary (1919), Limited	Toronto	Mar. 27	1,350,000
Super-Cement (America) Company, Limited	Toronto	Feb. 19	100,000
The Cassel Cyanide Company of Canada, Limited	Montreal	Aug. 3	50,000
Tide Water Oil Sales Corporation	Toronto	Aug. 27	40,000
Vermont Marble Company	Peterborough	May 1	150,000
Windsor Petroleum and Refining Company, Limited	Windsor	June 10	600,000
Total (12 Companies)			9,435,000

Companies which surrendered their charters were as follows:—

MINING COMPANY CHARTERS SURRENDERED IN 1920

Name of Company	Date of Dissolution
Elora White Lime Company, Limited	Nov. 13
Harris Consolidated Mines, Limited	Oct. 4
Keeley Mine, Limited	Nov. 15
Ontario Cement, Limited	May 10
St. Marys Cement, Limited	Feb. 2
The North Thompson Gold Mines, Limited	Dec. 20
Toronto Cement Products Company, Limited	Feb. 16

The following companies were authorized to increase their capital stock:—

INCREASE OF CAPITAL STOCK

Name of Company	Date	Increase of Capital Stock
		$ $
Goldsmith Brothers, Smelting and Refining Company, Limited	Oct. 20	40,000 to 200,000
Hunton-Kirkland Gold Mines, Limited	Nov. 10	1,500,000 to 2,500,000
Premier Langmuir Mines, Limited	July 19	2,000,000 to 2,800,000
The Cobalt-Frontenac Mining Company, Limited	Aug. 4	2,000,000 to 3,000,000

Mining Revenue

The revenue for the fiscal year ending October 31st, 1920, amounted to $1,117,499.55, the particulars being as follows:—

Sales of mining land		$39,095 28
Mining leases		22,411 64
Fuel investigation		84,246 97
Sand and gravel royalties		99,324 89
Sand and gravel rentals		3,576 68
Miners' licenses, etc		59,097 60
Mining Tax Act,—		
Acreage tax	71,223 26	
Profit tax	713,291 46	
Gas tax	22,525 80	
		807,040 52
Natural Gas Act, 1919		1,660 00
Provincial Assay Office fees		633 50
Miscellaneous		412 47
Total		1,117,499 55

MINING LANDS SOLD AND LEASED IN FISCAL YEAR ENDING OCTOBER 31st 1920

District	Sales			Leases			Total		
	No.	Acres	Amount	No.	Acres	Amount	No.	Acres	Amount
			$ c.			$ c.			$ c.
Timiskaming	314	11,342 01	29,258 34	104	5,159 56	1,567 43	418	16,501 57	30,825 77
Thunder Bay	29	1,045 80	2,484 50				29	1,045 80	2,484 50
Sudbury	18	755 61	2,270 25	10	449 00	449 00	28	1,204 61	2,719 25
Algoma	14	565 84	1,466 58				14	565 84	1,466 58
Kenora	12	474 97	1,227 05				12	474 97	1,227 05
Rainy River	8	921 31	2,209 88				8	921 31	2,209 88
Nipissing	1	50 00	150 00	2	69 10	28 23	3	119 10	178 23
Elsewhere	5	250 00	750 00				5	250 00	750 00
Total	401	15,405 54	39,816 60	116	5,677 66	2,044 66	517	21,083 20	41,861 26

A large quantity of sand and gravel is annually recovered by dredging in the great lakes and connecting rivers, under licenses from the Mines Department. Varying rates of royalty per cubic yard are collected. As shown above the revenue from this source for 1920 including license fees, was $102,901.57.

Under the Mining Tax Act, a graduated tax is levied on the profits of mining companies in excess of $10,000 per annum. The basal rate is 3 per cent., but there are special provisions for nickel-copper companies. The following statement gives details of the Profit tax for the last fiscal year.

DETAILS OF PROFIT TAX

GOLD:		
Dome Mines Company, Ltd.	$ 2,470 66	
Hollinger Consolidated Gold Mines, Ltd.	66,927 26	
Lake Shore Mines, Ltd.	3,392 67	
McIntyre Porcupine Mines, Ltd.	5,803 05	
		$ 78,593 64

SILVER:			
Bailey Silver Mines, Ltd.		$ 284 94	
Beaver Consolidated Mines, Ltd.		772 52	
Casey Kismet Mining Company, Ltd.		28 17	
Coniagas Mines, Ltd.		8,203 19	
Crown Reserve Mining Company, Ltd.		1,186 19	
Harris Consolidated Mines, Ltd.		345 26	
Kerr Lake Mining Company, Ltd.		13,739 74	
McKinley-Darragh-Savage Mines of Cobalt, Ltd.		3,244 09	
M. J. O'Brien, Ltd. (Miller-Lake O'Brien)		11,953 00	
Mining Corporation of Canada, Ltd.		3,769 86	
Nipissing Mining Company, Ltd.		82,297 43	
Trethewey Silver Cobalt Mine, Ltd.		779 49	
			$126,603 88
NICKEL-COPPER:			
International Nickel Co., of Canada, Ltd.			
Tax arrears (1918 and 1919)	$371,275 16		
Tax (1920)	132,793 56		
		$504,068 72	
Mond Nickel Company, Ltd.		3,841 38	$507,910 10
MISCELLANEOUS:			
Canadian Sulphur Ore Company, Ltd. (Iron pyrites)		$ 95 08	
Black Donald Graphite Company, Ltd. (Graphite)		88 76	
			$ 183 84
Total			$713,291 46

Provincial Assay Office

The Provincial Assayer, W. K. McNeill, reports as follows for the year 1920:

The Assay Office has been in operation without interruption during the entire year, and the usual variety of work has been done with the assistance of T. E. Rothwell, Chemist and Assayer, and Robert Stewart, Laboratory Assistant.

The work during the year may be classified as follows:

Gold, Silver and Platinum.—732 samples. A number of these were from Manitoba and the Maritime Provinces.

Cobalt and Nickel.—27 samples were tested and reports issued.

Copper.—62 samples. These samples were from widely distributed sources, but the majority from Ontario.

Feldspar.—2 samples were submitted for a complete analysis.

Iron Ores.—34 samples were tested for their iron content, and a number of them were analyzed also for sulphur and phosphorus.

Potash.—9 samples. These were mainly feldspars; six were also analysed for soda.

Rock Analyses.—19 specimens. Nineteen complete rock analyses were made. These samples were submitted by the geologists of the Department of Mines.

Radium.—A large number of samples were tested coming mainly from Butt township and Parry Sound district. A number were radio-active. A much larger number were brought to the Laboratory directly, and if not radio-active no records were kept.

Miscellaneous.—Seventy-one samples of other minerals were tested. These included lead, zinc, barite, molybdenite, vanadium, etc. Also a large number of samples of water were tested for oil.

Following is a statement of samples assayed free under the provisions of the Mining Act of Ontario. The first sample was received June 20th, 1920.

Mining Division	Samples received for free assay
Kenora	6 samples for gold.
Larder Lake	12 samples for gold, 4 for silver.
Montreal River	8 samples for gold.
Porcupine	7 samples for gold, 1 for silver.
Port Arthur	2 samples for gold.
Sudbury	15 for gold, 1 for silver, 1 for copper, 1 for iron.
Sault Ste. Marie	5 for gold, 1 for silver.
Timiskaming	9 for gold, 6 for silver, 1 for tin, 1 for sulphur.

The schedule of charges for work at the Provincial Assay Office and Chemical Laboratory is as follows:——

TARIFF OF FEES FOR ANALYSES AND ASSAYS.

1. Assays:

Gold	$1 50
Silver	1 50
Gold and Silver in one sample	2 50
Platinum Minerals	5 00
Gold and Platinum minerals in one sample	7 00
Separation of Platinum Minerals	Prices on application.

2. Iron Ores:

Iron (metallic)	$1 50
Silica	1 50
Iron and insoluble residue	2 50
Ferrous Oxide	2 00
Phosphorus	3 00
Sulphur	2 50
Iron, Sulphur, Phosphorus and insoluble	8 00
Manganese	3 00
Titanium	4 00
Complete analysis	Price on application.

3. Limestones, Dolomites, Marls, Clays, Shales:

Determination of:

Insolubles	$1 50
Silica	1 50
Ferric Iron	3 00
Ferrous Iron	2 00
Alumina	3 00
Lime	2 00
Magnesia	2 50
Potash	5 00
Soda	5 00
Alkalies (on one sample)	6 00
Water (combined)	2 00
Moisture	1 00
Carbon Dioxide	2 00
Sulphur	2 50
Phosphorus Anhydrite	3 00

4. Examination of Clay, Shale, or Cement Rock for Cement Manufacture:

Determination of:
Silica, Iron Oxide, Alumina, Lime, Magnesia, Sulphur, and Volatile matter ..... Prices on application.

5. Coal, Coke, Peat, etc.:

Determination of:

Moisture	$1 00
Volatile Combustible	1 50
Fixed Carbon	1 50
Ash	1 50
Sulphur	2 50
Phosphorus	3 00
Calorific value (B.T.U.)	5 00
Ultimate analysis	Price on application.

6. Mineral Waters .....Price on application.

7. Ores and Minerals:

Determination of:

Alumina	$3 00
Antimony	4 00
Arsenic	4 00
Bismuth	4 00
Cadmium	4 00
Chromium	5 00
Cobalt	5 00
Nickel	5 00
Cobalt and Nickel on same sample	6 00
Copper	2 00
Fluorite	4 00
Lead	3 00
Molybdenum	4 00
Manganese	3 00
Tin	4 00
Zinc	3 00

8. Rocks, Complete Analysis .....Price on application.
9. Slags, Sand, etc. .....Price on application.
10. Identification of Minerals and Rocks not Requiring Chemical Analysis..Free
11. Test for Radio-Activity .....Free.

Any analytical work not specified in this list will be undertaken on application to the Provincial Assayer.

The pulp of each sample is retained for future reference.

DIRECTIONS

Samples will be dealt with in the order of their arrival. In every instance specimens and samples should be accompanied by statement specifying the precise locality whence they were taken.

Crushed samples representing large quantities or samples less than five pounds weight may be sent by mail as third-class matter. The name and address of sender should be written plainly on each parcel. Instructions, with money in payment of fees, should be contained in a separate letter. Samples may be sent by express, charges prepaid.

Sample bags addressed to this Laboratory for sending ore pulp by mail may be obtained free on application; also canvas bags for shipping.

Money in payment of fees, sent in by registered letter, post-office order, postal note, or express order, and made payable to the Provincial Assayer, must invariably accompany sample to ensure prompt return of certificate, as no examination is commenced until the regulation fee is paid.

Samples should be addressed as follows:

Provincial Assay Office,

5 Queen's Park,

Toronto, Ont.

Departmental Correspondence

The volume of correspondence necessary for the work of the Department in all its branches is considerable. Figures supplied by the Files branch show that from 1st January to 31st October, 1920, communications received numbered 20,210, and communications sent out 21,125. New files issued were 585, and amount paid out for postage was $1600.

MINING ACCIDENTS IN ONTARIO, 1920

By

Chief Inspector of Mines, T. F. Sutherland, Toronto; Inspectors, G. E. Cole, Ottawa; James Bartlett, Sudbury; J. G. McMillan, Cobalt; A. R. Webster, Toronto

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During the year 1920 at the mines, metallurgical works, quarries, clay and gravel pits regulated by the Mining Act of Ontario, there were 26 fatal accidents, causing the death of 29 men, as compared with 39 deaths in 1919. Of these accidents, 13 occurred underground and resulted in 15 deaths. Six men were killed above ground at the mines, 3 at the metallurgical works and 5 at the quarries and clay and gravel pits.

Seventeen companies had fatal accidents during the year.

Six war veterans were among those killed.

Up to January 15, 1921, there had been reported to the Department for the year 1920, 1,497 non-fatal accidents at the mines and metallurgical works. Of these, 634 occurred underground, 372 occurred above ground at the mines, and 491 at the metallurgical works.

By months, the fatalities occurred as follows:

	1920
January	3
February	1
March	0
April	4
May	4
June	1
July	3
August	1
September	2
October	3
November	5
December	2
Total	29

The fatalities were divided amongst the several districts as follows:

Cobalt	3
Porcupine	7
Sudbury	11
Kirkland Lake	3
Southeastern Ontario	2
Southwestern Ontario	3
Total	29

Classifying the fatalities according to the industry gives the following:

Nickel mines and smelters	9
Iron mines	2
Silver mines and mills	3
Gold mines and mills	10
Limestone quarries	4
Gravel pits	1
Total	29

Table of Fatalities

	1916	1917	1918	1919	1920
Mines, underground	30	19	11	21	15
Mines, surface	7	7	4	6	6
Metallurgical works	8	6	12	10	3
Quarries	6	4	5	2	5
Total	51	36	32	39	29

Analysis of Fatalities at Mines

	1916 Per cent.	1917 Per cent.	1918 Per cent.	1919 Per cent.	1920 Per cent.
Falls of ground	24.3	15.4	20.0	22.2	23.8
Shaft accidents	27.0	15.4	0 0	29.6	9.5
Explosives	21.6	15 4	40.0	7.4	23.8
Miscellaneous underground	8.1	26.9	26.6	18.5	14.3
Surface	18.9	26.9	13.3	22.2	28.6

Table of Fatal Accidents in Mines, Metallurgical Works and Quarries, 1901 to 1920

Year	Persons killed at metallurgical works and mines	Persons employed at metallurgical works and producing mines	Persons employed at non-producing mines (estimated)	Total persons employed	Fatal accidents per 1000 employed
1901	13	4,135	550	4,685	2.77
1902	10	4,426	450	4,876	2.05
1903	7	3,499	400	3,899	1.79
1904	7	3,475	400	3,875	1.80
1905	9	4,415	500	4,915	1.83
1906	11	5,017	750	5,767	1.90
1907	22	6,305	1,140	7,445	2.93
1908	47	7,435	1,750	9,185	5.11
1909	49	8,505	2,000	10,505	4.66
1910	48	10,862	2,000	12,862	3.73
1911	49	12,543	2,000	14,543	3.37
1912	43	13,108	2,000	15,108	2.84
1913	64	14,293	2,000	16,293	3.93
1914	58	14,361	1,500	15,861	3.60
1915	22	13,114	1,500	14,614	1.51
1916	51	14,624	2,000	16,624	3.07
1917	36	16,791	1,000	17,791	2.02
1918	32	14,726	500	15,226	2.10
1919	39	11,926	1,000	12,926	3.00
1920	29	10,486	1,000	11,486	2.61

The occupation and nationality of the men killed are set out in the following table:

	English speaking	Austrian	Italian	Bulgarian	Belgian	Polish	Dutch	Norwegian	Spanish	Total
Labourer	5							1		6
Miner	3				1	1				5
Blaster	1	1		2			1			5
Millman	1		1							2
Hoistman	1	1								2
Brakeman	1	1								2
Mechanic			1		1					2
Cagetender	1									1
Sealer									1	1
Chuteman	1									1
Timberman			1							1
Manager	1									1
Totals	15	3	3	2	2	1	1	1	1	29

The ages of the men killed were as follows:

Age	17-20	21-25	26-30	31-35	36-40	41-45	51-55	Total
No. killed	3	7	7	2	6	3	1	29

The cause and place of fatalities in mines are noted below:

Below Ground:		Above Ground:	
Falls of ground	4	Crushed by machinery	4
Premature explosion	4	Falls	2
Remained too long lighting	1	Transportation	2
Cage accidents	1	Failure of derrick	2
Struck by skip	1	Thawing explosive	1
Rock falling from bench	1	Caught by blast	1
Buried in stope	1	Caught in belt	1
Falling from bench	1	Struck by log	1
Crushed by car	1		

Non-Fatal Accidents

The occupation and nationality of the men injured at the mines are shown in the following table:

Mines—Surface and Underground	English speaking	Italian	Austrian	Russian	Finnish	Polish	Bulgarian	Roumanian	Spanish	French	Serbian	Swede	Galician	Belgian	Greek	German	Dutch	Unknown	Total
Miner	190	60	65	39	28	34	13	7	5	3	1	2	2	1	1	2	1	3	308
Labourer	76	18	4	6	2	3	1	1		2	1		1		1			1	117
Trammer	46	8	27	8	1	4	3	3	2		1								103
Millman	40	7	1			1	1												50
Mechanic	29	10	2	1	2				1										45
Timberman	15	3	1		13				1									1	34
Carpenter	21			1	2					1									25
Foreman	15	5	1	2															23
Chute blaster	5	1	7	3		3	1				2			1					23
Electrician	10	1				1													12
Motorman	8	1	1		1		1												12
Blacksmith	10	1										1							12
Deckman	6	1	1					1									1		10
Teamster	10																		10
Scaler	4	2		2	1	1													10
Chute loader	2	1	1			1	1												6
Fireman	5																		5
Crusherman	3	1					1												5
Bushman	4	1																	5
Trackman	2	1	1	1															5
Blaster	1			1			2					1							5
Carpenter helper	3	1																	4
Shaftman		1			3														4
Nipper	3	1																	4
Engineer	4																		4
Assayer	4																		4
Cage tender	2			1															3
Cook	2																		2
Furnace operator	2																		2
Moulder	1																		1
Bricklayer	1																		1
Storeman	1																		1
Trainman	1																		1
Painter	1																		1
	527	125	112	65	53	48	24	12	9	6	5	4	3	2	2	2	2	5	1,006

The causes of the non-fatal accidents at mines are shown in the following table:

Cause of Accident	Surface	Underground	Total
Struck by rock when loading cars at chute		138	138
Handling rock or scaling	4	97	101
Fall of ground		76	76
Crushed or hit by ore car	12	60	72
Slipped, or tripped and fell	42	16	58
Sprain	25	24	49
Struck by falling objects	30	16	46
Crushed between two objects	22	17	39
Cut by metal, scrap, etc	14	18	32
Foreign matter in eye	15	16	31
Fell from elevation	15	13	28
Caught by machinery	26		26
Injured by tools	25	1	26
Struck by flying objects	10	11	21
Struck by falling drill		19	19
Injured by bar	8	11	19
Infection from cut	14	4	18
Fall	8	10	18
Burned	11	6	17
Stepped on nail	16		16
Injured by timber	7	9	16
Caught by drill	2	12	14
Hit by hammer	4	7	11
Injured by drill steel		11	11
Collapse of staging	3	7	10
Injured by cage or skip	3	6	9
Injured by particles dislodged by drill-bit		9	9
Hit by machinery	7	2	9
Caught by belt	8		8
Electric burns	7		7
Falling material in shafts		7	7
Rock knocked off cars by chute		6	6
Struck head against object	2	2	4
Falling off ladder in shaft		3	3
Poisoning	3		3
Caught in shafting	3		3
Miscellaneous	26		26
Total	372	634	1,006

The occupation and nationality of the men injured at metallurgical works are set out in the following table:

Occupation	English speaking	Italian	Austrian	Chinese	Russian	French	Polish	Finnish	Syrian	Roumanian	Macedonian	Serbian	Galician	Bulgarian	Total
Labourer	91	60	26	19	12	4	3	5	5	1	1	2	1		230
Furnace man	22	7	5		1	3	3			2	1			1	45
Mechanic	27	1	1												29
Furnace helper	5	5	5	1	4		1								21
Trainman	17														17
Smelterman	16														16
Foreman	12	4													16
Tuyere puncher	10		1			1	1								13
Carpenter	10						1	1							12
Blacksmith	7	3													10
Electrician	8														8
Cinder snapper	2	5					1								8
Scrapper		3	3												6
Craneman	5					1									6
Bricklayer	5														5
Trackman	1	3	1												5
Oiler	4	1													5
Ladleman		1	2				1								4
Scale carman	2	2													4
Cokeman	1	3													4
Rigger	4														4
Teamster	3														3
Trammer	2														2
Gas operator	1					1									2
Inspector	1														1
Stove cleaner		1													1
Motorman	1														1
Fireman						1									1
Miscellaneous	10		1		1										12
	267	99	45	20	18	11	11	6	5	3	2	2	1	1	491

Causes of the non-fatal accidents at metallurgical works are set forth hereunder:

Hit by falling objects	72	Hit by machinery	12
Burned by slag, matte, etc	38	Hit by flying objects	10
Burned at furnace	35	Injured by tools	10
Handling rock, ore, matte	35	Infection from wound	8
Slipped or tripped and fell	28	Electric burn	7
Injured by cars	22	Gas asphyxiation	4
Crushed between two objects	22	Injured by train	4
Burned	18	Poisoned	3
Cut by metal, scrap, etc	16	Fell off train	3
Hit by hammer	16	Fall of ore from chute	2
Sprain	15	Fall from vehicle	2
Injured by crane	14	Fall of staging	2
Foreign matter in eye	14	Internal injury carrying load	2
Stepped on nail	13	Injured by slag pot	2
Caught by machinery	13	Cut by saw	1
Burned by explosion of slag or matte	13	Miscellaneous	11
Fall from elevation	12		
Injured by bar	12		491

Table of Fatal Accidents in or about

No.	Date	Name of Mine	Name of Owner	Name	Occupation
1	Jan. 22.	Goldfields	Associated Goldfields Mining Co., Ltd.	Peter Sorle	Lumberman
2	Nov. 27.	Bailey	Bailey Silver Mines, Ltd.	Thos. Osborne.	Miner
3	Feb. 24.	Murray	British America Nickel Corporation	Fred. Doucette	Labourer
4	May 2.	do	do do	F. Chemetto	Timberman
5	Oct. 7.	Dome	Dome Mines Co., Ltd	Leon Stoffin	Miner
6	Apr. 28.	Hollinger	Hollinger Consol. Gold Mines, Ltd	Arthur Hartog	Blaster
	Apr. 28.	do	do do	John Todor	Blaster
	Apr. 28.	do	do do	K. Vachoff	Blaster
7	June 14.	do	do do	E. Pruin	Mechanic
8	Dec. 23.	do	do do	Nicola Torlone	Millman
9	Aug. 20.	Creighton	International Nickel Co. of Canada	Antonio Gagnon	Chuteman
10	Oct. 6.	do	do do	Stanley Smith	Blaster
11	Jan. 7.	Kirkland Lake	Kirkland Lake Gold Mining Co., Ltd.	E. H. Eagling	Miner.
12	May 24.	McKinley-Darragh	McKinley-Darragh-Savage Mines	John Staples	Millman
13	Jan. 12.	McIntyre	McIntyre Porcupine Mines, Ltd.	John Dolan	Miner
14	July 31.	Buffalo	Mining Corp. of Canada	Nicholas Galyk	Miner
15	Oct. 21.	Levack	Mond Nickel Co.	Francis Prefasi	Scaler
16	Nov. 12.	Levack	do	Pietro Pisani	Mechanic
17	July 7.	Moose Mountain,	Moose Mountain, Ltd	Wasyl Miniw	Blaster
18	Nov. 6.	Moose Mountain	do do	Mike Kosteniak	Hoistman
19	Apr. 22.	Teck-Hughes	Teck-Hughes Gold Mines, Ltd	James Keane	Cager

Table of Fatal Accidents at

No.	Date	Name of Mine	Name of Owner	Name	Occupation
20	May 12.	Copper Cliff Smelter	International Nickel Co. of Canada	John Dikor	Brakeman
21	July 2.	do	do do	Frederick Walker	Brakeman
22	Nov. 13.	Coniston Smelter	Mond Nickel Co.	Aldage Le Clair	Labourer

Table of Fatal Accidents at

No.	Date	Name of Mine	Name of Owner	Name	Occupation
23	Nov. 1.	Quarry	Britnell & Co., Ltd.	Robt. Wilson	Stat. Engineer
24	Dec. 29.	Gravel Pit	Howe's Farm	Lawrence Brouse	Labourer
25	Sept. 1.	Quarry	F. Rogers & Co.	Alexander Henry	Labourer
	Sept. 1.	do	do	Albert Maynard	Labourer
26	May 28.	do	Thames Quarry Co., Ltd.	John Bonis	Manager

the Mines of Ontario during 1920.

Nationality	Age	Married or single	Above ground	Below ground	Cause of Accident
Norwegian	39	S	1		Struck by log on skidway.
English	34	M		1	Buried by falling into raise with ore.
French-Canadian	38	M	1		Crushed between conveyor belt and pan feeder in rockhouse.
Italian	29	S		1	Run over by skip in shaft.
Belgian	37	S		1	Fell from bench into stope.
Dutch	39	S		1	
Bulgarian	23	S		1	Explosion while loading holes.
Bulgarian	23	S		1	
Belgian	43	M	1		Fell from top of waste bin in crusher house.
Italian	23	S	1		Caught by belt while putting same on moving bull wheel.
French-Canadian	19	S		1	Crushed between car and timber at ore dump.
English	29	S		1	Remained too long lighting fuses.
English	26	S		1	Fall of ground in stope.
English	42	S	1		Struck by scoop of tube mill.
Canadian	20	S		1	Fall of ground in stope.
Russian Polish	30	S		1	Fall of rock from wall of open pit.
Spanish	24	M		1	Fall of ground in stope.
Italian	24	S		1	Fall of ground in stope.
Austrian	40	M		1	Explosion occurred while loading.
Austrian	32	S	1		Crushed against briquette car.
Irish	24	S		1	Drill steel caught in timber and threw him off cage.

Metallurgical Works, 1920.

Nationality	Age	Married or Single	Cause of Accident.
Canadian	28	S	On top of locomotive cab and fell under train.
English	20	S	Fell off running board and under locomotive.
French-Canadian	24	S	Fell while repairing roof of shed.

Quarries, Clay and Gravel Pits, 1920.

Nationality	Age	Married or Single	Cause of Accident
Canadian	40	M	Explosion of dynamite being thawed on forge.
Canadian	27	S	Returned too soon to scene of blasting.
Canadian	45	M	Struck by boom when derrick collapsed.
Canadian	26	M	Struck by boom when derrick collapsed.
Canadian	51	M	Crushed by car.

The occupation and nationality of the men injured through the use of explosives are set out in the following table:

Occupation	English speaking	Russian	Polish	Finnish	Austrian	Spanish	Italian	Total
Miner	5	1	2		2		1	11
Labourer	1			2		1		4
Blaster		2						2
Craneman	1							1
	7	3	2	2	2	1	1	18

The causes of the non-fatal explosives accidents are shown in the following table:

Premature blast	6	Preparing charges	1
Striking unexploded charge in removing debris	4	Not warned of shooting in drift	1
Drilling into unexploded charge	2	Light went out and walked towards blast in error	1
Not taking proper cover	1	Injury to ear by concussion	1
Tamping charge	1		18

Prosecutions

The Beachville White Lime Company, Limited, were fined $100.00 and costs by Police Magistrate Alfred S. Ball, at Woodstock, on April 19, 1920, for an infringement of Rule 221, Section 164, Part IX, of the Mining Act of Ontario. The office was being used as a thawing room.

Mike Bokla, a trammer boss in the Hollinger mine, was fined $100.00 and costs on September 3, 1920, by Police Magistrate Atkinson, at Timmins, for violating Rule 19, Section 164, Part IX, of the Mining Act of Ontario. Bokla neglected, on August 27, to guard an approach to a place in the mine where he was blasting.

Britnell and Company, Limited, were fined $100.00 and costs by Magistrate F. D. Moore, at Lindsay, on November 25, 1920, for non-compliance with Rule 12, Section 164, Part IX, of the Mining Act of Ontario. The blacksmith forge was being used to thaw dynamite.

J. W. Simpson, manager of the Cobalt A. 53 mine, was fined $200.00 and costs by Police Magistrate Atkinson, at Haileybury, on December 6, 1920, for an infringement of Rule 12, Section 164, Part IX, of the Mining Act of Ontario. Dynamite was being thawed in the hoist house.

The Point Anne Quarries, Limited, was fined $100.00 and costs by Police Magistrate S. Masson, at Belleville, on December 18, 1920, for an infringement of Rule 4, Section 164, Part IX, of the Mining Act of Ontario. The company was using a magazine for explosives without a permit from the Inspector of Mines.

MINES OF ONTARIO

By

Chief Inspector of Mines, T. F. Sutherland, Toronto; Inspectors, J. G. McMillan, Cobalt; James Bartlett, Sudbury; A. R. Webster, Toronto

1.—NORTHWESTERN ONTARIO

Gold

Contact Bay Mines, Limited.—This company, mention of whose holdings was made in the Twenty-ninth Annual Report of the Ontario Department of Mines, continued to prospect the Bonanza claim near Dryden, Ontario, throughout 1920, but stopped all work on the last day of the year with the expectation of resuming in the spring. Twenty-two men were employed under the direction of Harry S. Badger, manager, and E. S. Henley, superintendent.

On a vein dipping at 75 degrees to the north a two-compartment shaft was sunk to a depth of 88 feet. A level was opened at 85 feet and drifts run 126 feet east and 90 feet west of the shaft; in the west drift at 80 feet from the shaft a raise was driven to 59 feet above the level.

J. N. Beckley, 326 Cutler Building, Rochester, N. Y., is president of the company and J. R. L. Starr, 120 Bay Street, Toronto, secretary.

Foley.—Swedish-Canadian Mines, Limited, did no work in 1920 other than sampling the Foley gold mine near Mine Centre, Ont. The officers of the company are: president, Senator George W. Fowler, Ottawa; vice-president, W. D. McKay, Toronto; secretary-treasurer, Gideon Grant, Toronto; directors: N. T. McMillan, Winnipeg; Clayton S. Corson, Toronto; C. R. Fitch, Fort Frances, Ont. H. R. Drummond-Hay, Winnipeg. Frank Carnegie, Mine Centre, Ont., is manager.

Grace.—In the autumn of 1920 workmen were engaged in preparing the buildings and plant of the Grace gold mine on Eagle lake in the Manitou Lake region. It is planned to do some underground prospecting in No. 1 shaft. This shaft consists of two compartments, is 115 feet deep and from it 51 feet of lateral work was done some years ago. The work is being undertaken by The Grace Mining Company, Limited, whose Canadian office is at Fort Erie, Ont., and United States office at 300 Broadway, Buffalo, N. Y., Captain Walpole Roland, Box 515, Kenora, Ont., is supervising the work; the captain is 94 years of age and a veteran of the Crimea, the Indian mutiny, the Chinese expedition and the American civil war. Mail is sent to the mine via Vermilion Bay, Ont.

This mine should not be confused with the Grace gold mine in the Michipicoten region.

Wachman.—The Wachman Mining and Milling Company, Limited, carried on work south of Dryden until December, 1920, when the workmen were paid off. When work was stopped a two-compartment shaft, known as the No. 2 or west shaft, had been sunk 100 feet on a narrow quartz vein dipping at 85 degrees to the north, and eight feet of station cutting had been done on the 100-foot level. There is also a second shaft to the east, known as No. 1, which is 31 feet deep. Both shafts are on the southern part of claim K. 646.

The machinery in use consisted of a locomotive-type and a Jenckes marine boiler, a Canadian Rand straight-line compressor, and a James Cooper Manu-

facturing Company hoisting engine, 6-inch by 8-inch. Buildings added since last year are:- blacksmith shop, magazine, superintendent's house, and another log camp. Thirty-one men were employed, of whom four were working underground.

The officers of the company are: president, Robert Wachman, Dryden, Ont., vice-president, Edward L. C. Morse, Chicago; secretary and treasurer, A. Rosenberg, 1302 Milwaukee Ave., Chicago.

Iron Pyrites

Northpines.—The Northpines mine of the Nichols Chemical Company at Northpines, Ont., was operated during all of 1920 but stoping was stopped in October and for the remainder of the year only shaft-sinking was done. The last of the stockpile was shipped in November.

No. 1 shaft which consists of two compartments, has been straightened and is now vertical; it is 337 feet deep and is now connected with the fourth level workings. The main or No. 2 shaft, which contains three compartments, has been sunk to the sixth level and measures 624 feet on the slope; it is at 59 degrees for the first 320 feet and at 55 degrees for the remainder. In February, 1921, the fifth and sixth level stations were being cut and a skip-loading device was being placed above the sixth level. During 1920 pyrite was mined from the second level east, the third level east and the fourth level east and west.

A combined dormitory and change house has been built with a ground area of 11,800 square feet; it has a concrete basement and is plastered outside and in with cement plaster.

The head office of the company is at 25 Broad Street, New York and the head of the mining and metallurgical department is Robert H. Cromwell. The officers residing at Northpines are: superintendent, J. P. Flynn, Jr.; surveyor, A. G. Morrison; master mechanic, D. J. Rees; mine foreman, George Schmelzer. Until the reduction of force in the fall from 180 to 205 workmen were employed.

II.—THUNDER BAY, MICHIPICOTEN AND SUDBURY

Gold

Kirk Gold.—The Kirk gold mine, operated by Kirk Gold Mines Company, Limited, and situated on Bass lake north of Bruce Mines, was described in the Twenty-ninth Annual Report of the Ontario Department of Mines. When inspected on February 3, 1921, the underground work completed consisted of the following: the two-compartment shaft, which was sunk on the vein at 55 degrees, measured 126 feet; on the 50-foot level a drift extended 200 feet to the east and at 160 feet from the shaft a raise had been completed to surface - a distance of 210 feet; an adit level, the portal of which is near the shaft collar, had been driven 330 feet to the east. Fifteen men were employed at the time of inspection and all work was then being done on the adit level.

The head office of the company is in the Kent Building, Toronto; the post office address of the mine is Lecburn, Ont. The officers are: president, George A. Bull, Brampton, Ont.; directors, G. A. Gillespie, Peterboro, Ont.; R. B. Burkell, Toronto, Ont.; C. L. Messecar, Brantford, Ont.; secretary, Zeba Gallagher, Toronto. The mine manager is Major E. H. Birkett.

Manxman or Norwalk.—The Manxman or Norwalk mine is described in the Eleventh and Eighteenth Reports of the Bureau of Mines. It consists of 16 or 17 mining claims and is four miles east of the Mission in the Michipicoten region.

The Grace Mining Company, Limited, started overhauling the machinery in October, 1919, and began work underground in January, 1920. The company also had an option on the Grace gold mine nearby but did no work there.

The Manxman was inspected on May 5, when 26 men were employed and only shaft-sinking was being done. The shaft then measured 254 feet on the slope. It follows the vein which lies at about 45 degrees for 240 feet and at 75 degrees for the remaining 14 feet. Drifting has been done to the northwest on two levels; on the 110-foot for about 100 feet and on the 200-foot for 120 feet. The present owners did about 75 feet of the drifting on the 110-foot level and stoped to a height of 30 feet above the level. Some stoping was done on the 200-foot level by the former owners. A few days after the inspection was made, the company stopped all work.

The machinery at the mine includes the following: a 45 h. p. boiler; an Ingersoll-Sergeant compressor driven by a 50 h. p. General Electric motor; a Marsh and Henthorn hoisting engine, 6 inches by 8 inches; a 30 h. p. Westinghouse motor driving a 9-inch by 16-inch jaw crusher and also an aerial tramway leading from the crusher to the mill; three 50 k. w. Westinghouse core-type transformers, 10,000 primary to 220 secondary.

The mill ran for three weeks in February. It contains a boiler, a 46 h. p. engine and ten Fraser and Chalmer stamps No. 112, and amalgamating plates.

Electric power is obtained from the Algoma Power Company's plant at High Falls on the Michipicoten river.

The company is capitalized at $1,000,000 and has its office at 1509 Cornelia Avenue, Chicago. The nearest post office to the mine is Michipicoten River, Ont. The officers of the company are: president, Wm. A. Burmeister, Chicago; vice-president, Henry Schefe, Appleton, Wis.; secretary, G. M. Bruss, Chicago; treasurer and manager, J. Martyn Stewart, Michipicoten River, Ont.

St. Anthony.—A syndicate consisting of C.L. Campbell of Montreal, C. P Charlebois and W. H. Fairburn of Toronto, has obtained a lease of the St. Anthony mine on Sturgeon Lake and is treating tailings. In 1920, 1200 tons were reground and passed over amalgamating tables. No underground work was done.

Webb-McCarthy.—In December Major J. H. Rattray, acting on behalf of individuals whose names have not been made public, obtained an option on four of the Webb-McCarthy gold claims east of the Goudreau pyrite mine. The claims were staked in 1917 by W. J. Webb and D. J. McCarthy of Sault Ste. Marie, Ont.

Iron

Leitch.—The diamond-drilling being done on the Leitch iron claims, which are east of Lake Nipigon and six miles north of Beardmore station, was stopped in May, 1920.

Magpie.—The Magpie mine of the Algoma Steel Corporation, Limited, was worked during all of 1920, and the roast-plant was run except during period when repairs were being made. The output for the year amounted to 115,337 short tons of product; shipments totalled 106,241 tons all of which went to the Corporation's blast furnaces at Sault Ste. Marie, Ont.

The four-compartment vertical shaft now measures 591 feet to the bottom of the skip pit and 611 feet to the bottom of the drift beneath the pentice. When inspected on October 30, the orebody was being developed on the fifth level, and the drifts then extended 202 feet east and 169 feet west of the station crosscut. There were 173 men employed at this time and 83 of these were underground workmen.

The officers of the mines department of the Corporation are: secretary, George S. Cowie, Sault Ste. Marie; mine superintendent, George R. McLaren, Magpie Mine, Ont.; assistant superintendent, Robert P. Weldon, Magpie Mine, Ont.

Moose Mountain, Limited.—Moose Mountain, Limited, operated its mine and mill at Sellwood, Ont., until November 29, when both were shut down. During 1920 there were treated 58,690 (long) tons of ore which yielded 24,242 (long) tons of briquettes.

The company is capitalized at $4,000,000 and has the following directorate: president, Charles E. Herrman, Scarsdale, N.Y.; James C. Hutchins and John J. Mitchell, of Chicago; Wm. Mackenzie and Donald D. Mann, of Toronto; Chas. H. Smith, John B. Dennis, Augustine L. Humes, David Dows and John F. Harris, of New York. The secretary and treasurer is Albert Moreau, 17 Battery Place, New York and the head office is at Sellwood, Ont.

The officers resident at Sellwood are: general manager, A. J. Anderson; general superintendent, George C. Baer; mine superintendent, John G. Barron; mill superintendent, R. Sturgeon; master mechanic, C. A. Stahl.

Nickel and Copper

British America Nickel Corporation

Nickel and Copper.—The British America Nickel Corporation, Limited, owns nickel-copper mines and a smelting plant in the Sudbury district and a refinery at Deschênes, Que. The officers during 1920 were: president, James H. Dunn, New York; vice-president and managing director, W. A. Carlyle, Ottawa; secretary-treasurer, S. M. Brown; consulting engineer, A. Gronningsater, Ottawa, electrical engineer, R. F. Howard; purchasing agent, T. N. Hay; manager of mines, Ernest Hibbert; manager of smelter, E. J. Carlyle; manager of refinery, R. L. Peek; refinery superintendent, T. Torrel; chief engineer, J. H. Gillis. The Canadian head office is in the Jackson Building, Ottawa.

At the time of writing (March, 1921) a reorganization of the Corporation is being effected.

Nickelton Smelter.—The new nickel-copper smelter at Nickelton, Ont., was blown in on January 17, 1920. One furnace was operated for the remainder of the year, and for a short time two were in blast.

The following quotation is taken from an article by managing director W. A. Carlyle that appeared in the Canadian Mining Journal of March 18, 1921:

> The smelting practice has many features different from that followed by the other smelters in the Sudbury district. The ore, averaging SiO_2 24%, Fe 35%, CaO 3.7%, MgO 4.3%, Al_2O_3 6%, S. 19%, is smelted without any preliminary roasting and the only flux is converter slag containing SiO_2 16%, Fe 52%, CaO 3.5%, Al_2O_3 3.5%, the charge consisting of 70 to 75% ore, the balance flux with 10.5% coke on the charge. The resulting slags contain SiO_2 35.5%, Fe 30%, CaO 5.5%, Al_2O_3 13%, and 0.24 to 0.34% nickel plus copper plus cobalt.
>
> The low-grade matte from this furnace, containing 11 to 13% nickel and copper, is poured into the converters, and blown up to the usual matte containing 80 to 82% copper and nickel and a trace of iron, which is transferred to an oil-fired furnace, and in running thence through a strong stream of water is very successfully granulated, then wheeled into box cars and shipped to the refinery.
>
> In the converters the flux is mainly ore fines with some siliceous gravel or sand. One aim is to keep the silica in the converter slag as low as possible, it often averaging for days under 13%; this eventually will become the regular practice. This slag is run in part into 20-ton cars poured outside the building upon shallow beds lined with ore fines, broken up and lifted by locomotive cranes using clam-shell buckets and sent to the smelter bins. Part of the slag is poured into the settlers.
>
> The capacity of the blast furnaces is proving much greater than anticipated. For the past three months one furnace has averaged over 800 tons of ore per day, and 1,015 tons of ore have been smelted in one day, counting in the ore used as flux in the converters. In the future, greater results will be achieved especially if the ore fines under 1½ inches, now going to the furnaces, are sintered; this problem is now being studied. The flue dust, which is small in amount, is caught in the dust flues and chambers. The smelter stack is 300 feet high and 25 feet inside diameter.

The officers at the smelter are: manager of smelter, E. J. Carlyle; superintendent of smelter, Oliver E. Jager; blast furnace superintendent, T. Willard Cavers; converter superintendent, B. C. Tomlinson.

On February 26, 1921, the Corporation closed the smelter indefinitely owing to the condition of the metal market.

Murray.—The development work at the Murray mine of the British America Nickel Corporation, Limited, was continued throughout 1920, but the shaft was not sunk any deeper. Stoping has been started. The rock house has been in operation since January 16, 1920.

The officers at the Murray are: manager of mines, Ernest Hibbert and superintendent, H. L. Roscoe. The force at the end of the year numbered 400, of whom 300 were underground workmen.

With the exception of a few men, the mine employees were paid off on February 26, 1921, at the same time as the smelter was closed.

International Nickel Company of Canada

The International Nickel Company of Canada, Limited was licensed in Ontario on Jan. 6, 1917, and since that time has owned and operated the mines and smelter in the Sudbury district that were formerly worked by the Canadian Copper Company. The company also owns a nickel refinery at Port Colborne, Ont. The officers are: president, A. D. Miles, Toronto; vice-president and general manager, J. L. Agnew, Copper Cliff, Ont.; secretary-treasurer, James L. Ashley; directors, A. D. Miles, W. A. Bostwick, J. L. Agnew, Britton Osler, W. B. Lawson, Alfred Jaretzski, R. C. Stanley, John More. The head office is in the Harbour Commission Building, Toronto.

In 1920 the company had an average of 1623 employees in the Sudbury district; this number does not include those working on the construction of the Big Eddy dam, which was completed toward the end of the year.

The International Nickel Company owns all the stock of the International Nickel Company of Canada, Limited. The authorized stock of the parent company consists of: $50,000,000 in common shares (par $25), $41,834,600 outstanding; and $12,000,000 in 6% non-cumulative preferred shares (par $100), $8,912,600 outstanding. The officers of the parent company are: president, W. A. Bostwick; 1st vice-president, R. C. Stanley; secretary-treasurer, James L. Ashley; comptroller, James W. Beard; directors, E. C. Converse (Chairman of the Board), W. A. Bostwick, Admiral Willard H. Brownson, Ambrose Monell, Chas. Hayden, A. D. Miles, W. E. Corey, William T. Graham, Thos. Morrison, Alfred Jaretzski, R. C. Stanley, William Nelson Cromwell, Seward Prosser. The general offices are at Constable Hook, Bayonne, New Jersey, and the executive and financial offices at 67 Wall Street, New York.

The officers residing in Copper Cliff, in addition to those mentioned elsewhere in this report, include: vice-president and general manager, J. L. Agnew; general superintendent, J. C. Nichols; superintendent of mines, E. T. Corkill; master mechanic of mines, David Butchart; electrical superintendent, J. B. McCarthy; transportation superintendent, G. A. Sprecher; safety engineer, William O. Tower.

The following information is abstracted from the nineteenth annual report of the parent company and covers the fiscal year ending March 31, 1921.

Condition of Plants and Reserve Accounts:—During the fiscal year a sum of $1,356,811.47 was expended for additional property, construction, and equipment as follows: Port Colborne plant $6,862.48, Copper Cliff smelter and hydro-electric plant $1,087,984.99, Orford works $84,815.23, and the Huntington plant $177,148.77. Recoveries for the same period were $42,200.97, making the net addition to Property Account $1,314,610.50.

There has been provided out of the earnings the sum of $2,147,150.15 for the following funds: Regular allowance for depreciation $1,577,312.59, and exhaustion of minerals $569,837.56.

Inventories:—The inventories, amounting to $11,891,078.23, include the following items: ores, matte and metals in process $5,259,130.23, refined metals $4,211,234.80 valued at cost, in no case in excess of present market value, and general supplies, flux, fuel, etc. $2,420,713.20, valued at cost or replacement value as of March 31, 1921.

Net profits for the Year:—The net profits for the fiscal year, after deducting expenses, depreciation, exhaustion of minerals, provision for foreign and United States taxes and all other charges, were $2,029,699.83, which, after paying the 6% dividends on the preferred stock, is equivalent to approximately 3.6% on the common stock, or 90 cents per share of par value of $25.00.

Surplus:—The company's surplus is now $11,886,177.21, as compared with $10,391,233.38 on April 1, 1920.

General:—During the first six months of the present fiscal year a fair volume of business was done, but during the last six months, as the general industrial depression increased and the deflation process progressed, the volume of business was very materially decreased.

There were stocks of nickel, as well as secondary or scrap metals, still remaining in the European markets at the begining of the year, and these have been only partly liquidated during the year. The continued unsettled conditions in the European consuming industries, together with the presence of the stocks already referred to, the difficulties of financing purchases and the abnormal conditions of foreign exchange have caused the volume of foreign business during the year to be inconsiderable. The indications of the last two months in the United States, however, are that stocks in many consumers' hands are gradually becoming exhausted, and the result has been an increased demand, not as yet large in volume, but from an increasingly large number of consumers.

During the first half of the fiscal year the company's operations were at (approximately) sixty per cent capacity. In the second half, as the volume of business became less, the operations were restricted, until at the conclusion of the year the plants were being operated at about twenty per cent. capacity, but with sufficient organization retained, and with the plants maintained in such condition as will enable them to increase operations quickly, as the demand for the company's products increases.

It is encouraging to be able to report that considerable progress has been made during the year in the development of markets for Monel metal and nickel in various rolled forms produced by the company, and the prospects of continued expansion in these lines are excellent. To provide the facilities necessary to develop further this profitable branch of its business, the company has decided upon the construction of rolling mills of its own, which will enable it to provide the service in deliveries and quality of these rolled products so essential in expanding the market for their uses. The company has acquired an excellent site of approximately eighty acres on the Guyandotte river near Huntington, West Virginia, with the facilities in fuel, power, transportation, and labour admirably adapted to its needs. The construction of this plant is now actively progressing and it is anticipated that the plant will be producing before the close of this year.

During the year four quarterly dividends of 1½% each on the preferred stock of the company have been paid out of the earnings of the fiscal year. No dividends have been declared or paid on the common stock, it having been deemed advisable to maintain the financial position of the company and to conserve its cash resources for such further capital expenditures as will be necessary to complete the new rolling mills now under construction.

The number of stockholders is now 16,206.

Creighton Mine.—During 1920, the Creighton No. 3 shaft (55 degrees) was sunk still deeper; it now consists of five compartments to a vertical depth of 1527 feet and one compartment from this point to a vertical depth of 1880 feet below surface. At the bottom of this shaft the 30th level has just been started. A 45-degree winze, known as "No. 10 hanging-wall winze", extends from the 20th to the 30th level - a vertical distance of 600 feet. Diamond-drilling is being done from two points in this winze.

The average number of men employed at the Creighton during the year was 591, and the shipments of ore totalled 783,292 tons, as compared with 356,143 tons in 1919.

The staff at the mine includes: superintendent, Geo. A. Morrison; assistant superintendent, W. J. Rolfe; mine foremen, K. C. Browne and Chas. Collins; master mechanic, John Symons; electrician, Everett Gillespie.

Frood or No. 3 Mine.—This mine has not been worked by the International Nickel Company since August 8, 1914. In the summer of 1920 it was bailed out and 100 tons of ore obtained for experimental purposes. The mine was then allowed to fill again. Some diamond-drilling was also done from the surface until power became scarce owing to the summer drought.

Dill quarry.—Dill quarry at Quartz, Ont., was worked during the summer of 1920, and 68,302 tons of quartzite were shipped to Copper Cliff smelter for flux. In September the pit covered an area of 161,850 square feet and averaged 60. feet in depth. W. H. Roach was superintendent until August, when Walter Blackwell took charge. Sixty men were employed.

Fig. 1—Main high tension line switching structure.
International Nickel Company, of Canada, Limited.

Copper Cliff Smelter.—The average number of blast furnaces in operation at Copper Cliff in 1920 was between four and five. The reverberatory furnaces and some of the Wedge furnaces were run all year.

Construction work done consisted of: the veneering of the smelter power-house, the adding of a new switch room to this building, and the erection of the steel frame-work to house a Dwight-Lloyd sintering plant.

The officers at the smelter are: superintendent of smelter, Wm. Kent; assistant smelter superintendent, Donald MacCaskill; metallurgist, James W. Rawlins; master mechanic of smelter, George R. Craig; blast furnace foreman, Peter McDonald; converter foreman, Frank Taylor; reverberatory furnace foreman, J. K. Workman.

Substation.—Extensive additions and alterations to the main substation at Copper Cliff were recently completed. The major portion of the power developed at its hydro-electric plant is distributed from this point, and all load dispatching and switching for the various mines and other operating properties is under the control of the Copper Cliff operators.

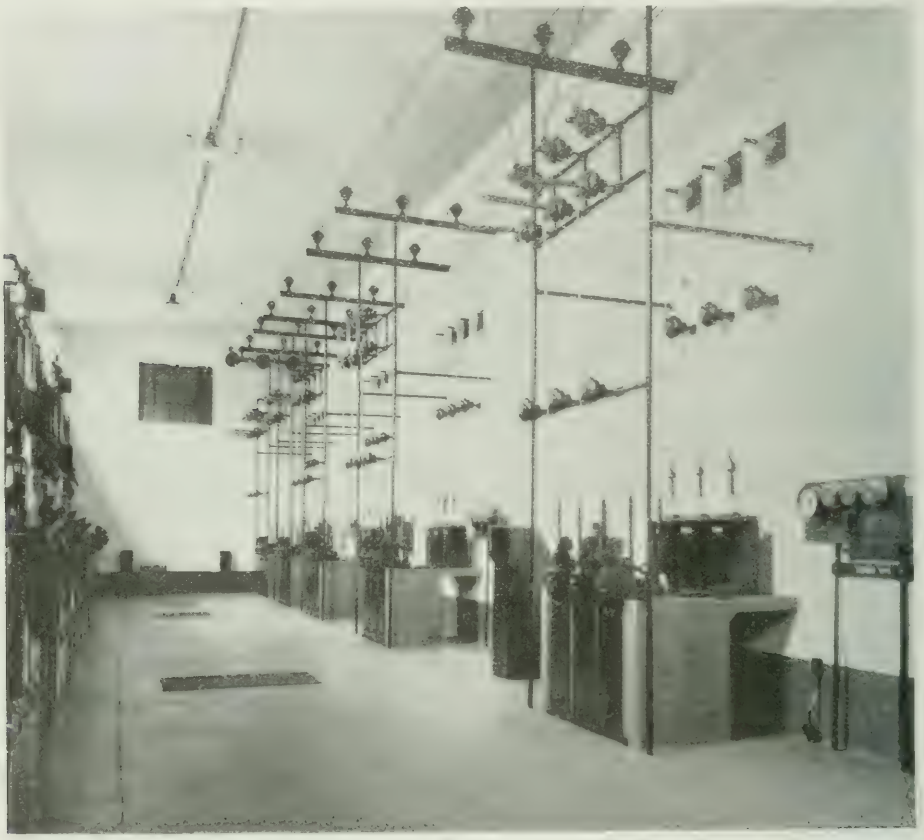


Fig. 2.—High tension transformer switch structure.
International Nickel Company of Canada, Limited.

A large increase in generating capacity at the power plant, and also the increase of connected load, particularly that driven by synchronous motors, rendered necessary the replacing of the old switching equipment with a more modern design having a larger rupturing capacity. At the same time it was decided to so lay out the plant that maximum security to life and property would be secured without resorting to unnecessary complications. In the selection of the equipment the ultimate development of the hydro-electric plant was considered.

Current is delivered to this substation at 33,000 volts, three phase, 25 cycles, over two parallel lines mounted on the same pole structure from the company's hydro-electric plant at High Falls. A main terminal tower close to the entrance serves as a support for the complete electrolytic lightning arresters equipment, and also for a three pole lever-operated Burke horngap switch for each line. All power can be completely cut off outside the station, in an emergency, by means of these switches.

From the tower, the two lines enter the building through porcelain bushings cemented in the brick wall. Immediately inside are the line suspension choke coils from which the lines pass through heavy oil circuit breakers (Fig. 1) with condenser bushings and disconnecting switches, to the main high tension bus bar. The high tension bus bars are supported on 44,000 volt pin-type insulators with strain insulators at each end. From this bus bar, current is distributed through high tension oil circuit breakers with disconnecting switches to four banks of transformers with a normal capacity of 2,000 K. V. A. each (Fig. 2). Each bank consists

Fig. 3 Main 2,400 volt switching structure.
International Nickel Company of Canada, Ltd.

of three single phase oil-insulated water-cooled transformers, which reduce the voltage from 33,000 to 2,400 volts. Each bank is enclosed in a separate fire-proof compartment and each transformer is provided with wheels and mounted on rails to facilitate placing it under the crane for repairs.

The low tension bus bar (Fig. 3) is divided into four sections by means of bus tie oil circuit breakers. Ground detectors are suitably placed, and used in conjunction with the bus tie breakers, serve to isolate a ground quickly on the 2,400 volt

lines. All lines going outside the station are connected to one bus section, and at time of lightning disturbances this section is isolated from the others, thus confining the disturbance to a single section.

From the 2,400 volt bus bar current is distributed through a heavy duty feeder oil circuit breaker and disconnecting switches to the starting panels (Fig. 4) of each large motor, and to a transformer bank of 500 K. V. A. capacity at 550 volts. A small bus for the town and plant lighting, another for motor generator sets and fire pump are each protected in the same manner.

The small distributing bus bar structures (Fig. 5) are mounted on a gallery immediately above the main operating board (Fig. 6) and all circuit breakers on this structure are mechanically operated from the main board below.

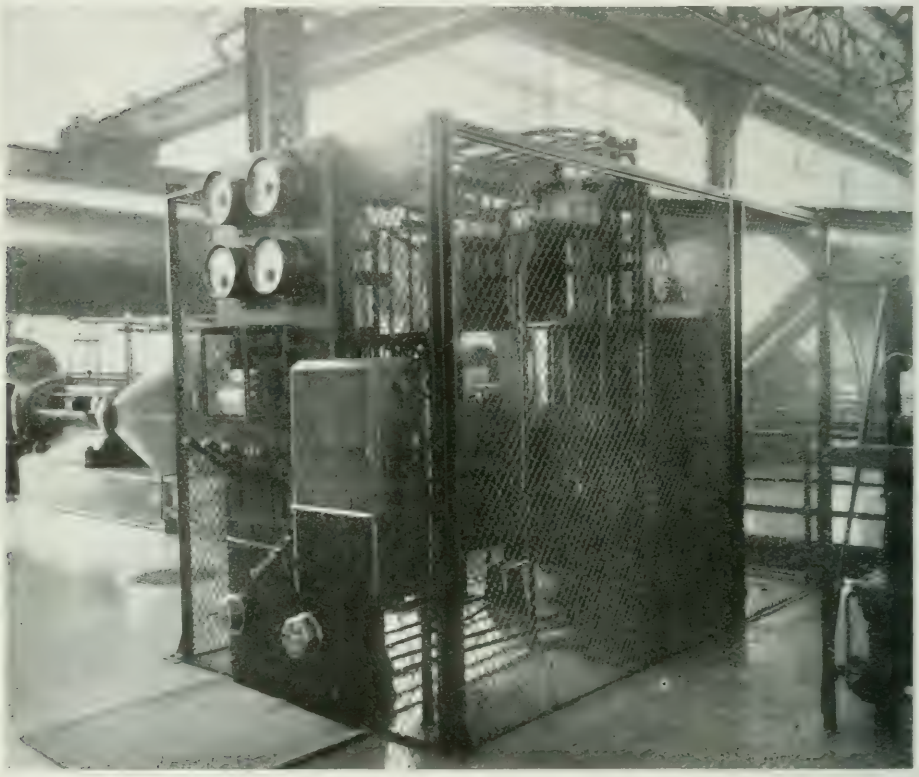


Fig. 4—R. B. S. motor starting panel. International Nickel Company of Canada.

In connection with the 2,400 volt distribution, it might be interesting to note that of the total connected load, approximately 10,000 H. P. is for air compressing (Fig. 7) for blast furnaces, converters and shops. Of the motors, probably the most interesting is the 2,600 K. V. A., 1,500 R. P. M., 2 pole synchronous motor driving a large centrifugal converter blower. This is believed to be the largest 25 cycle motor of this type built to date.

All main circuit breakers, both high and low tension, are electrically operated through solenoids. Energy is obtained for these, as well as for the various indicating and signalling devices, from an Edison storage battery. The battery is charged from the locomotive circuit.

In order to get a proper record of the distribution of power, meters have been installed as indicated. Each feeder is provided with an ammeter operated from a rotary switch for reading the current in each phase. Totalizing meters, both of the graphic and integrating tupte, are connected to record the total input, while a recording voltmeter and wattless component meter indicate the voltage and wattless current respectively. Whenever further division is required, the necessary meters are installed.

Fig. 5—Bus structure for auxiliary. International Nickel Company of Canada, Limited.

Protection of the equipment has been given careful consideration and the salient feature of the scheme adopted follow; first of all, every oil circuit breaker has a set of disconnecting switches to isolate it from the course of power. The main line circuit breakers are connected through reverse power relays actuated from current transformers in each phase to open, in case of trouble on either line, the circuit breaker that will cut out the line in trouble. The same current transformers are also connected through overload relays to cut either or both main circuit breakers in case of overload.

Each transformer bank is provided with a current transformer on each phase, both high and low tension operating in connection with relays on the differential plan to cut out both high and low tension transformer breaker in the event of trouble in a transformer. The transformers, by a slight unbalance between the high and low tension current transformers, are further protected against overload external to the transformer with the same arrangement.

Each feeder breaker is equipped through relays with overload protection. When the feeder breaker supplies a large motor, additional protection is provided through the overload breaker on the starting panel. When the feeders supply a small distributing bus, the individual feeders from this bus bar are similarly protected.

All relays are of the wattmeter type and therefore, a selective action is obtained all over the system, tending to isolate troubles and reduce the interruptions to a minimum.

All power cables, also control and meter wiring are run in either fibre duct or iron conduit to the various points, and large pull boxes are provided to render inspection and installation easy. A large number of spare ducts and cells are installed for future developments.

An oil treating outfit is installed to take care of the transformer oil. This includes two large tanks, one placed above the transformers, the other in the basement, and the necessary piping. An oil filter and dehydrator is also provided to clean the dirty oil. With this outfit, transformer oil is quickly and easily handled.

Very effective lighting has been secured from using gas filled lamps of large size with deep bowl reflectors installed above the crane track. The units are spring suspended to protect the lamps from vibration. The switch room is electrically heated with 8 K. W. air heaters operated from a 550 volt circuit.

All switching equipment was supplied by The Canadian Westinghouse, Limited, and installed by The International Nickel Company of Canada, Limited.

The accompanying diagram (insert) shows the arrangement of high and low tension lines, feeders, etc. In addition it shows the meter and control for the high tension lines and also typical transformer and feeder control and metering diagrams.

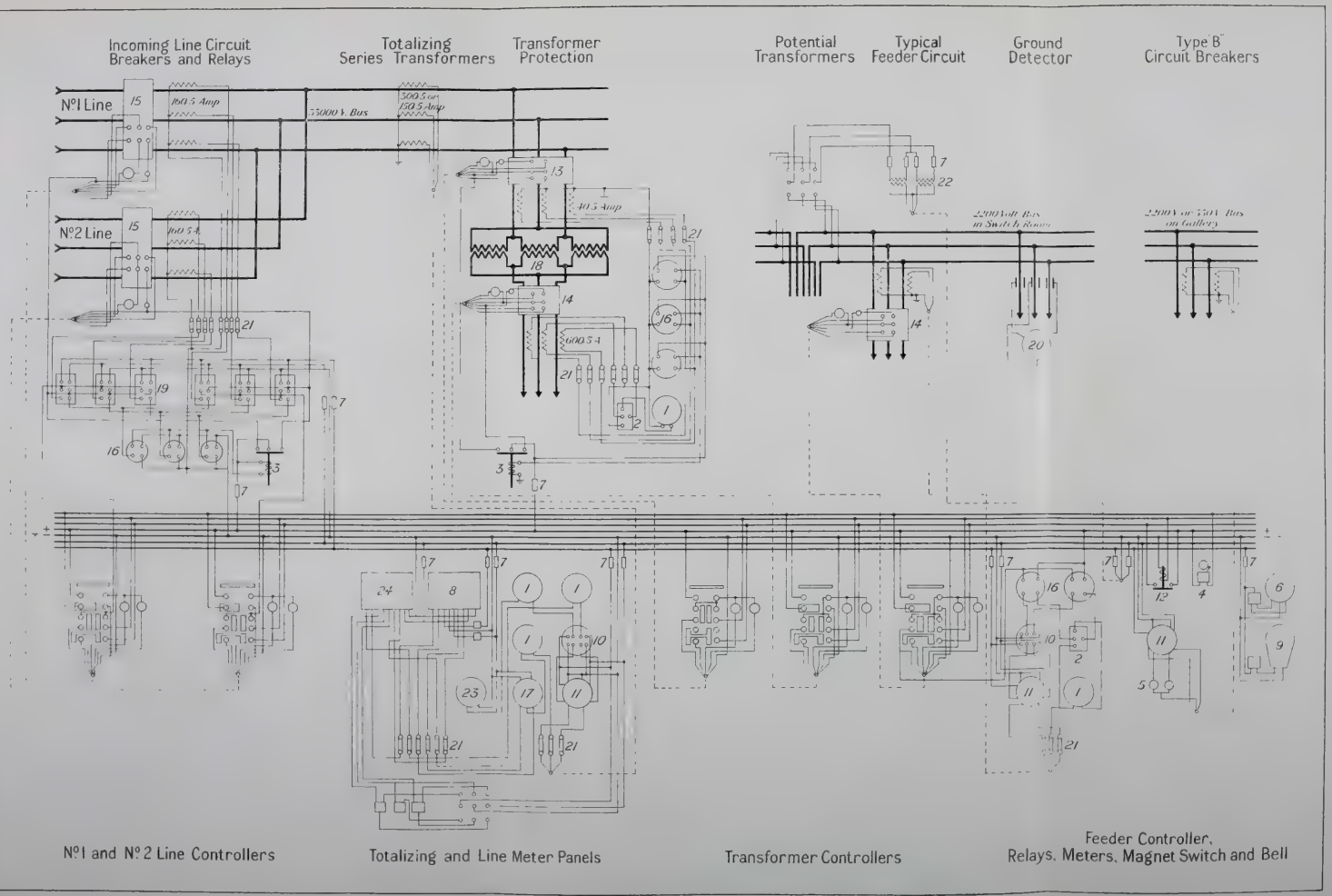


Diagram of Control Wiring, Copper Cliff Substation, International Nickel Company of Canada, Limited

EXPLANATION OF REFERENCE NUMBERS.

1—Ammeter.
2—Ammeter Switch.
3—Ammeter Relay, 3 point.
4—Bell.
5—Circuit Breaker, type "B," Overload Coils.
6—Frequency Meter.
7—Fuse.
8—Graphic Totalizing Wattmeter.
9—Graphic Voltmeter.
10—Indicating Wattmeter.
11—Integrating Wattmeter.
12—Magnet Switch.
13—Oil Circuit Breaker, type "E."
14—Oil Circuit Breaker, type "E. H."
15—Oil Circuit Breaker, type "G. A."
16—Overload Relays, type "C. O."
17—Power Factor Indicator.
18—Power Transformers.
19—Reverse Power Relays, type "C. R."
20—Static Ground Detector.
21—Test Links.
22—Transformers, two 2K. V.A., 2000-100 Volts.
23—Voltmeter.
24—Wattless Component Meter.

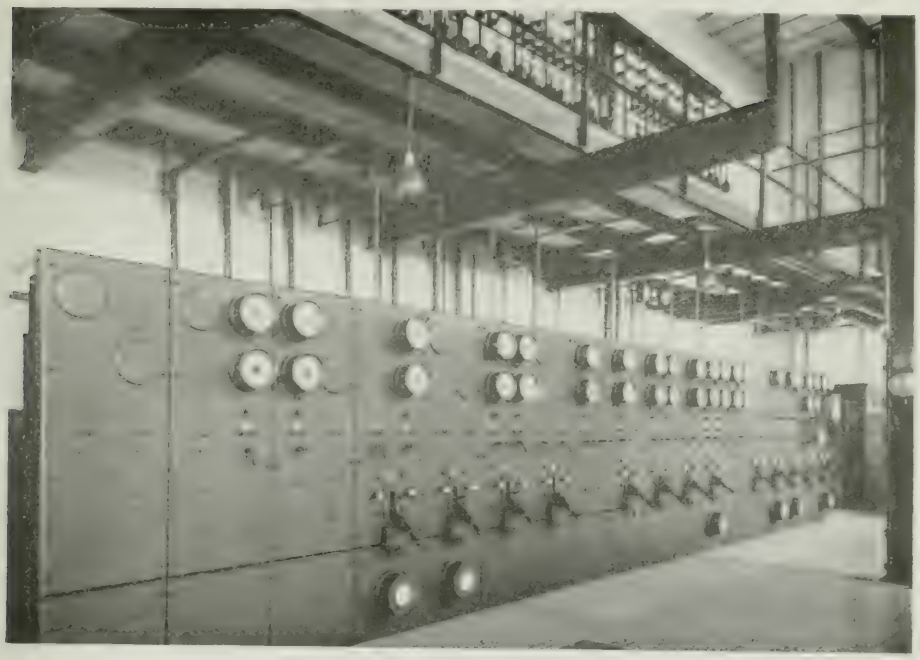


Fig. 6 –Main operating panel board.

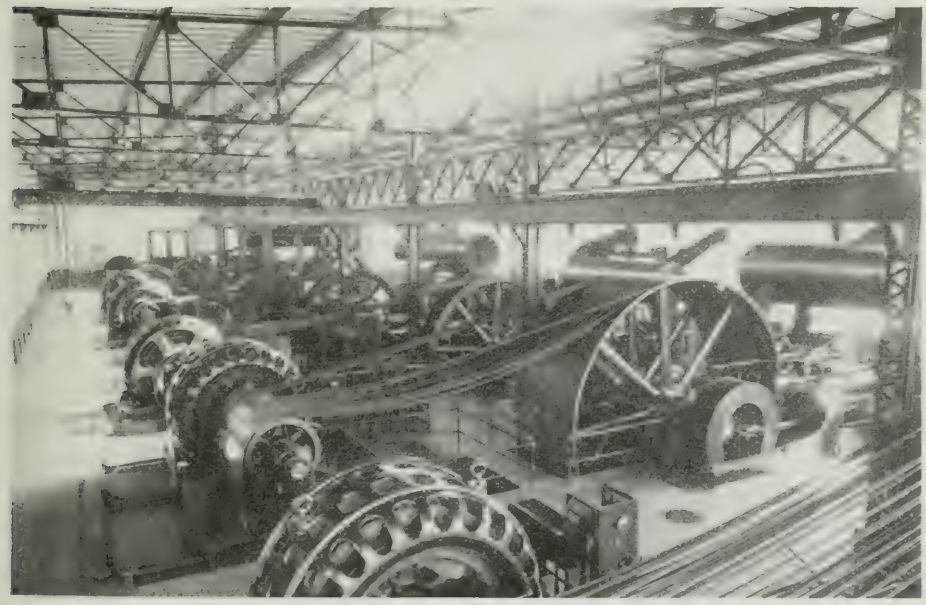


Fig. 7—Smelter compressor building.
International Nickel Company of Canada, Limited.

International Nickel Company of Canada, Limited

Big Eddy conservation dam, gravity type, on the Spanish river, lot 2, concession II, Hyman township, three-fourths of a mile above the present power development at High Falls. The dam (length 1125 feet, maximum height 146 feet) contains 80,704 cubic yards of concrete, including 4685 cubic yards in caisson piers.

Big Eddy Dam.—This conservation dam is on the Spanish river in lot 25, concession II, township of Hyman, three-quarters of a mile above the present power development at High Falls.

The dam is of gravity type and contains 80,704 cubic yards of concrete, including 4,685 cubic yards in caisson piers. Total length of dam is 1,125 feet, consisting of west wing and non-overflow section of 102' 6", an overflow section of 173', a regulating sluice section of 60', an overflow section with log-slide and trash-run of 240' 6", a head work section of 164', and an east wing and non-overflow section of 385'. Greatest height of dam from river bed to top of overflow section is 146'. Greatest thickness of dam at regulating valve tube is 100'. Thickness at bottom of dam at penstock section is 78', and the width at top ranges from 36' over the penstock section to 5' at top of non-overflow sections.

Regulating sluices for draining off from storage are three in number, controlled by Larner-Johnston hydraulic operated valves. Regulating valves have cast iron bodies 5' 10" thick and 9' 11½" at greatest diameter.

Overflow sections are divided by piers into 17' bays, and provided throughout with guides for stop logs.

The log slide is of reinforced concrete supported by concrete arches at inner end and the outside end rests on solid rock. The log slide is 330' in length, inside width at dam 8', tapering to 4' at lower end.

Mond Nickel Company

The Mond Nickel Company was incorporated in Great Britain on September 20, 1900. The capitalization of the company is now £3,400,000 made up as follows: £500,000 in 7 per cent cumulative preferred shares, par £1; £2,000,000 in 7 per cent non-cumulative preferred shares, par £1; £900,000 in common shares, par £1. The secretary's office and the sales office are at 39 Victoria Street, London, S. W. 1, England; the Canadian office is at Coniston, Ont.; and the refining works are at Clydach, Wales. The secretary is D. Owen Evans.

The directors of the company are: chairman, Robert L. Mond; Sir E. J. Griffith, S. W. A. Noble, Sir Robert Hadfield, Emile S. Mond, Dr. Carl Langer, Robert Mathias, Sir Byron Edmund Walker, C. V. Corless. C. V. Corless, Coniston, is managing director, and O. Hall, Coniston, superintendent of mines.

Coniston Smelter.—One blast furnace and one converter, out of four furnaces and four converters, were operated duing 1920 at the Mond Nickel Company's smelter at Coniston. No heap roasting has been done since 1918.

J. F. Robertson is superintendent of reduction works, E. T. Austin superintendent of the smelter, and K. S. Clarke superintendent of the sintering and flotation plants.

Bruce Mines.—The shipments of siliceous copper ore from the Bruce copper mines at Bruce Mines, Ont., to Coniston smelter totalled 25,639 tons for the year.

At the Taylor shaft drifting was continued on the vein on the 155-foot level until the face was 1,907 feet to the southeast of the shaft; 650 feet of back was cut out to a height of 12 feet and made ready for stoping. All work was stopped at this shaft on September 30, 1920.

At "old No. 4" shaft the following work was done: on the fourth (320-foot) level a pillar was removed above No. 54 stope; on the fifth (420-foot) level No. 54 stope was worked out and at 1550 feet to the northwest of the shaft a raise was driven to the 225-foot level of the Western shaft connecting at a point 25 feet to the south-east of the western shaft bottom.

At the Western shaft a little stoping was done above and below the 225-foot level.

At "old No. 2" shaft part of the shaft pillar was drawn and some stoping was done between this shaft and the Western under a caved area between 265 feet and 340 feet from the surface. This is supposed to be in the vicinity of the Palmer shaft, where an extensive cave-in occurred about 1876. In doing this stoping an old winze, having a drift and crosscut at the bottom, was encountered to the west of the caved area; 70 feet of this winze remained intact, but the upper part had been crushed. In the drift at the bottom of the winze there were found two of the old type of Cornish wheelbarrows and the miners' tools as they had left them when going off shift—probably at some time in 1876.

It may be worth recording that on the 420-foot level of "old No. 4" shaft at the face of a crosscut to the southwest of No. 51 drift a pink to white quartzite is exposed for 35 feet. The contact of this quartzite with the diabase dips at 10 or 15 degrees to the southeast. This is the only point in the underground workings where quartzite is known to have been found.

In February, 1921, all work was stopped at these mines and they were allowed to fill.

A. D. Carmichael, who was in charge here for some years, was transferred to the Worthington mine early in 1920; he was succeeded at the Bruce mines as superintendent by H. A. Steven, who remained in charge until the mine was closed. The working force numbered 60.

Garson.—The Garson mine shipped 35,541 tons of ore to Coniston in 1920. Stoping was carried on between the third and sixth levels and the third-level floor pillar was taken out. On the tenth (1,000-foot) level 150 feet of drifting was done. From 70 to 80 men were employed.

Captain A. L. Sharp is superintendent, and Chas. Caesar and Alex. Pollock, mine foremen.

Victoria.—At the Victoria mine the number of men employed in 1920 varied from 50 to 85. The only new development work undertaken was the sinking of a winze on the west orebody to a depth of 34 feet below the eighteenth or 3,000-foot level. At the bottom of this winze a small amount of ore was taken out; stoping was also done on the west orebody above the second, fourth and sixteenth levels. Floor pillars were removed on the thirteenth and fourteenth levels and part of that on the sixteenth was taken out. Shipments for the year amounted to 20,915 tons.

W. J. Mumford, Mond, Ont., is superintendent.

Worthington.—No development work was done at the Worthington mine in 1920. Stoping was continued east of the shaft above the third, fourth and fifth levels and west of the shaft above the fourth and fifth.

The shipments for the year amounted to 20,375 tons and about 70 men were employed.

J. G. Harris resigned as superintendent in March and was succeeded by A. D. Carmichael of the Bruce mines. Wm. McKerrow is mine foreman.

Levack.—The work accomplished at Levack mine in 1920 was as follows: raising, 385 feet; drifting, 365 feet; diamond drilling, 2,013 feet; section cutting, 19,029 square feet; ore shipped to Coniston, 31,820 tons. Stoping was done only above the fifth level and chiefly in No. 54 stope. From 70 to 80 men were employed

The mine officers in 1920 were: superintendent, Frank J. Eager, and mine foreman, Andrew Taylor.

Morin.—In November and December, 1920, some diamond-drilling was done on the Morin property, which lies to the northwest of the Crean Hill mine. It consists of the north half of lot 6, concession V, Denison township and is owned by Joseph Morin and J. McFadden of Sudbury.

Iron Pyrites

Goudreau.—The Nichols Chemical Company, Limited, stopped work on January 9, 1920, at the Goudreau pyrite mines, Goudreau, Ont. During the summer pyrite was shipped from the stockpile at the mine. D. J. Rees was superintendent.

Morrison No. 3.—The engine house, change house and blacksmith shop at the Morrison No. 3 property of the Nichols Chemical Company, Limited, were destroyed by fire on November 26, 1919; the headframe was not damaged. Since the fire no work has been done at this property.

When the fire occurred, the development work done in the mine was as follows: the three-compartment shaft on claim A. C. 40 measured 230 feet at an angle of 47 degrees; on the 100-foot level about 347 feet of drifting and crosscutting had been completed, and on the 210-foot level about 848 feet. D. J. Rees, Goudreau, Ont., was superintendent.

Rand Consolidated.—Rand Consolidated Mines, Limited, (capitalized at $5,000,000) which has been carrying on work in the Goudreau area for several years past did nothing in 1920 on the Morrison No. 4 property near Goudreau Station but began to prospect the Morrison No. 2 group of claims a mile and a quarter south of Goudreau Station. In June all work was stopped.

The last inspection was made on May 4, when an adit was being driven west on the Morrison No. 2 into a high ridge west of mileage 175.75 of the Algoma Central and Hudson Bay railway. The portal is 1,200 feet west of the railway and 250 feet above it. On the date mentioned the adit was 107 feet into the hill and measured 13 feet in width; the height of the first fifty feet was 12 feet and of the remainder 9 feet. This adit is driven in the footwall of the more southerly of one of two bands of iron formation that strike west, dip to the north at 70 degrees and are some 600 feet apart. It was stated that the company planned to mine both pyrite and siderite from the south deposit.

Near the portal a change house and blacksmith shop had been completed, and beside the railway an office and large log sleeping and dining camps were being built. There were 70 men employed of whom 32 were working in the mine in three shifts.

The head office of the company is at 621 Farmers' Bank Building, Pittsburgh, Pa.; Edwin Ohl is president and Fred E. Powers treasurer; both of Pittsburgh. The resident officers were general manager, John T. Jones, Goudreau; superintendent, Edward C. Gluck; mining engineer, A. E. Flynn.

Silver

Federal Mining Company, Limited.—This company was incorporated on November 10, 1919, with a capitalization of $40,000, to prospect a claim for silver some thirteen miles west of Fort William in lot 26, concession B, Paipoonge township. The officers of the company are: president and manager, Franklin S. Wiley, 213 Park St., Port Arthur; director and secretary, F. Cranford Gibbs, Port Arthur; directors, W. L. Brown, Chicago, Ill., W. D. B. Turville, Port Arthur.

Work was started in January, 1920, and at the end of the year a shaft had been sunk on the vein for 75 feet and at the bottom 15 feet of drifting had been done to the northwest and 11 feet to the southeast. When the last inspection was made in September, the vein which strikes in a northwesterly direction showed a did of 65 degrees to the southwest; it was from 32 to 48 inches in width and consistep of calcite, quartz— a little of which is amethystine—some pyrite and occasional specks of zinc blende and galena; argentite is said to have been encountered in several places in the shaft. The wall rock is slate. Eight men were employed under the direction of foreman George Copeland.

Silver Islet.—The Silver Islet mine near Thunder cape is owned by The Nipigon Mining and Lands Company, of which Sydney T. Miller, Penobscot Building, Detroit, Mich., is secretary.

After lying idle since the early part of 1884, this mine was pumped out by means of an air-lift to a depth of 110 feet and sampled by R. C. Jamison and D. C. Peacock, 509 Alworth Building, Duluth, Minn. Preparatory work was started in May and the sampling of this upper portion of the mine was completed at the end of July; after this was done, the mine was allowed to fill again. Contrary to the general opinion the mine does not make much water. During the following winter some diamond-drilling was done from the surface of the island, and it is the intention to do some crosscutting in 1921. Jamison and Peacock have provided a locomotive-type boiler and a Canadian Fog Signal air compressor 12 inches by 14 inches by 12 inches. Charles W. Greenlee supervised the pumping and sampling and had eight men employed.

A fire on May 15, 1920, destroyed the two shafthouses, the engine house and the office.

Porcupine.—Jamison and Peacock of Duluth did 30 feet of crosscutting in January and February, 1920, on the second level of the Porcupine silver mine in the Rabbit Mountain area.

Quartz Quarries

Bellevue.—The McPhail and Wright Construction Company, Limited, of Sault Ste Marie, Ont., worked its quartz quarry on the Algoma Central near Bellevue during the summer. The rock quarried is a quartzite, probably of the series generally referred to as "iron formation." There is no power plant at this quarry, the drilling being done by hand and the cars lowered to the bins at the railway and returned by means of a gravity plane. Fifteen men were employed when the quarry was inspected on June 29, 1920. The quartzite is sold to the Algoma Steel Corporation.

Kenneth Wright, Sault Ste Marie, Ont., is manager of the company and C. L. Aronson is quarry foreman.

Killarney.—The quartzite quarry near Killarney, which had been closed down since October, 1918, was worked during the season of navigation by Electro-Metals, Limited, with a force of from 20 to 25 men.

Since the equipment at this quarry was described in the Twenty-Fourth Annual Report of the Ontario Bureau of Mines, numerous changes have been made. The quartzite in the pit is now loaded by a Marion steam shovel into cars which are hauled up an incline to the crushing plant by a Beatty and Sons'

three-drum contractor's hoisting engine. In the crusher house are: a Power and Mining Superior jaw crusher with 40-inch by 42-inch jaw opening, a 48-inch trommel with 5-inch openings, a No. 6 Gates gyratory crusher, a 36-inch pan conveyor and a rail grizzly. From a small bin the crushed material feeds upon a horizontal conveying belt, which discharges above a stockpile. Beneath the stockpile is a tunnel containing a belt conveyor, used in loading the boats. The power house contains; a Jenckes and a Polson return tubular boiler, a 200 h. p. Robb-Armstrong engine, a Canadian Rand 14-inch by 22-inch compressor, a Fairbanks-Morse dynamo, and a Marsh and Henthorn 5-inch by 7-inch hoist for raising coal from the lake shore to the boilers. A machine shop has been built and equipped with a Bertram lathe, a Smith and Mills shaper, a Novo gas engine, a 24-inch drill, and a Clark emery grinder.

George W. Rayner, 410 Crown Office Building, Toronto, is manager and Dan Chisholm, Killarney, Ont., foreman.

Trap

City of Fort William.—The city of Fort William has for several years been obtaining trap for road building from a quarry at the foot of mount McKay near the rifle ranges. In June, 1920, this quarry was abandoned and a crushing plant was being set up nearby to crush trap talus at the foot of the mountain. This work is in charge of Cyril Symmes, city engineer, Fort William.

Marrigan.—Chambers, McQuigge and McCaffrey Co., Limited, continued to work the Marrigan trap quarry at Bare point, Port Arthur, during 1920 and had 65 men employed. The rock is all used for the breakwater in Port Arthur harbour.

The machinery in use at this quarry includes: a Canadian Ingersoll-Rand 16 by 10 by 12-inch compressor driven by a 100 h. p. motor, a Marion steam shovel, and four dinkey locomotives.

C. McQuigge, Walsh Block, Port Arthur, is manager.

III.—DISTRICT OF TIMISKAMING

Gold

Boston Creek

Miller Independence.—The Miller Independence Mines, Limited, continued in 1920 to prospect their property, which consists of the south half of lot 1, concession VI, Pacaud township, in the Boston Creek area. The officers of the company are: William Stroop, president; George W. Ozias, vice-president; John C. Schaeffer, secretary treasurer. The other members of the board of directors are: O. B. Brown, John A. Read, J. A. Begard, B. B. Van der Voort, Philo G. Burnham, T. E. Tucker. W. E. Simpson, Boston Creek, Ont., is manager, and an average of 30 men is employed.

The following account of the work done in 1920 is summarized from the report of the manager:

Electrical power is now used at this mine instead of steam. This change has necessitated the expenditure of nearly $50,000 and has involved the building of over two miles of transmission line and a sub-station. The boiler plant is being kept as a reserve. The pistons were removed from the air compressor and a 100 h. p. motor provided to operate it by means of a belt leading to the fly wheel from a jack shaft.

The main or "A" vertical, two-compartment shaft, which was 427 feet deep at the begining of the year, was sunk to 515 feet, and a level opened at 509 feet. A crosscut has been driven northward on this level for 525 feet and will be continued to the northern boundary. At slightly less than 200 feet from the shaft a fracture was encountered, that is believed to be the downward continuation of one encountered in the "D" shaft. A drift, headed northeast along this fracture, had advanced 52 feet at the end of the year. On meeting the fracture a crosscut was also started westward towards the "Jumbo" vein; this crosscut measures 315 feet. At a point 320 feet north of the shaft 64 feet of crosscutting due east was done.

In the "D" shaft, which is a 45-degree incline, 35 feet of drifting was done on the 200-foot level. On the surface a rock-cut, over 200 feet long, was excavated to divert a creek and thereby prevent the seepage from finding its way into the "D" workings.

A laboratory sampling equipment, consisting of a Sturtevant crusher, a set of rolls, and a small concentrating table, has been purchased; this will handle sample lots of ore of 40 or 50 pounds.

Beatty Township

Premier.—Premier Gold Mining and Exploration Company, Limited, was incorporated on November 3, 1919, with a capitalization of $2,000,000. The company has mining claims in lots 10 and 11, concession V, Beatty township, northeast of Matheson, and carried on work during the summer of 1920 with a force of 14 men in charge of James A. Burke. The property was formerly known as the "Hill."

The total underground work done on this property to date consists of a 200-foot incline shaft with levels at 100 and 200 feet, about 150 feet of drives on the 100-foot level and about 300 feet on the 200-foot level. The work done during the summer consisted of 200 feet of this lateral work, mostly on the 200-foot level.

The plant consists of a 40 and a 60 h. p. boiler, a 9-drill Ingersoll compressor and an 8-inch by 10-inch Jenckes hoist.

Work was stopped about September 1.

Kirkland Lake

Bidgood.—Bidgood Gold Mines, Limited, was incorporated March 26, 1919, with a capital of $2,000,000 in $1.00 shares, to work eight unpatented claims aggregating 234 acres in Lebel township. The officers are: George Tough, president; E. W. Kearney, secretary; C. E. Rogers, consulting engineer. The head office of the company is at 806 Ferry Street, Niagara Falls, Ont., and the mine office is at Haileybury, Ont.

Early in the year a power house, good camps to house 25 men, and a 35-foot head frame were erected. A 65 h. p. boiler, a 6-inch by 8-inch Jenckes hoist, and a four-drill Rand two-stage compressor were set up and shaft sinking was started under contract on April 22 by Dan Hughes. This contract covered the sinking of a two-compartment shaft to a depth of 316 feet and the driving of 775 feet of drifts and crosscuts, mainly on the 300-foot level, to explore No. 4 and No. 9 veins. An average of 20 men was employed.

Some surface prospecting was also done on Nos. 2 and 3 veins to trace their extensions beyond the area previously trenched.

The work was stopped on November 3, 1920.

Fidelity.—Fidelity Mining and Development Company, Limited, incorporated May 14, 1917, with an authorized capital of $2,000,000 in shares of $1.00 par value, owns wholly or partly about 35 claims in the townships of Teck, Lebel, Morrissette, Turnbull, Grenfell, Alma, Catharine, and Skead. All assessment work has been completed except on three claims in Lebel and four in Catharine township.

During 1920 about 1,500 day's work, consisting of surface prospecting, was done by the company on its holdings in Lebel, Catharine, and Skead townships; the greater part of this was on a block of 12 claims in Skead at the north end of St. Anthony lake. Several promising veins were exposed and it is expected that further work will be done on these in 1921

The most extensive work was done on mining claim L.2845 in Teck township where nothing had been done since the strike in 1919. Work was resumed in February, 1920, with a force of 20 men. After a sump was cut and 30 feet of drifting done on the 140-foot level, a contract was let to Church and Burton on April 30 and sinking began. On this contract, which was terminated on Dec. 30, 145 feet of shaft sinking was done, and 717 feet of driving done on the 300-foot level. In No. 325 drift on this level a considerable flow of water was encountered 100 feet northwest of the shaft; as continuous pumping failed to drain this, a dam was built and the drift diverted around and beyond the water-bearing zone. The best results were obtained in this No. 325 drift over a section about 70 feet long, begining 70 feet northwest of the shaft and continuing to the face of the drift; these results were so encouraging that it is planned further to explore this area.

T. B. Tough is president of the company, and E. W. Kearney, Haileybury, is secretary.

Hunton-Kirkland.—Hunton-Kirkland Gold Mines, Limited, was incorporated on January 30, 1914, with a capital of $1,500,000. The directors are: Thomas Birt, president; David Elliott, vice-president; Arthur Hunton; J. Walter Young; H. M. Porteous, manager. The company owns mining claims 16,620 and 16,621 comprising 80 acres and situated half a mile south of the Lake Shore mine in the township of Teck.

A power house and a residence for the manager were built, and a plant provided, consisting of a three-drill compressor driven by a 50 h. p. motor, and a 6-inch by 8 inch hoisting engine. A two-compartment shaft was sunk to a depth of 65 feet.

Kennedy Boston.—Kennedy Boston Gold Mines, Limited, was incorporated March 21, 1919, with an authorized capital of $2,000,000 in $1.00 shares to work the south half of lot 11, concession VI, Catharine township. The officers are: W. C. Kennedy, president; E. W. Kearney, secretary; Duncan Campbell, manager; C. E. Rodgers, consulting engineer. The head office is at Haileybury, Ont.

In 1920 the company carried on work intermittently during the first seven months of the year. Surface trenching was done, the two-compartment shaft sunk from 50 to 150 feet, and 250 feet of drifting and crosscutting done on the 150-foot level. In addition to this, some 200,000 feet of lumber was sawn on the property. From five to fifteen men were employed.

King-Kirkland.—The King-Kirkland Gold Mines, Limited, owns mining claims 8001, 4117, 4118, 2910, 2929, and L. 5108 in the township of Lebel. The directors are: C. F. Jordan, Toronto, president; E. L. Wettlaufer, Toronto, vice-president; A. B. Crosby, Toronto, treasurer; G. M. A. Davidson, Unionville, Ont., secretary; John Swartz, Kitchener, Ont., Major D. Sprague, Keswick, Ont.; Duncan McLellan, Brantford, Ont.

During the summer surface prospecting was done and comfortable office and camp buildings erected. During the winter a 6-inch by 8 inch hoisting engine and a 25 h. p. boiler were bought and a shaft 80 feet deep was sunk on the No. 5 vein.

Ernest Craig is superintendent.

Kirkland-Combined.—Kirkland-Combined Mines, Limited, was incorporated on May 28, 1917, with a capital of $2,000,000. The property of the company is north of the Sylvanite mine.

The company began underground work in December, 1919, and ceased in 1920 after sinking a shaft to a depth of 200 feet and doing 110 feet of crosscutting on the 200-foot level.

A. W. Grierson was manager.

Kirkland Lake—Kirkland Lake Gold Mining Co., Ltd. operated throughout the year. The mill treated 45,479 tons of ore and $277,007.09 in gold was recovered. The development during the year was: drifting 1,500 feet, crosscutting 554 feet, raising 292 feet, sinking 115 feet, and station cutting, 233 cubic yards. No. 2 shaft has been continued from 700 to 900 feet in depth and a large electric pump installed on the 800-foot level. The drift on the 900-foot level is being extended under the central shaft, which is now 520 feet deep. This shaft will be continued to the 900-foot level,

The officers and directors are: F. L. Culver, president; William Thomas Mason, vice-president; R. Graham, secretary-treasurer; F. L. Lovelace and H. E. Tremain, directors. W. M. Sixt is mine superintendent.

Lake Shore.—The Lake Shore mine at Kirkland Lake worked continuously throughout 1920. This mine is owned by the Lake Shore Mines, Limited, which has an authorized capital of $2,000,000 in shares of $1.00 par value. The officers of the company are: Harry Oakes, president and managing director; Arthur G. Slaght, vice-president; W. H. Wright, 2nd vice-president; Dr. W. P. St. Charles, treasurer; Kirkland Securities, Limited, secretary; R. C. Coffey, mine manager. The directors are: Harry Oakes, Arthur G. Slaght, Dr. W. P. St. Charles, C. E. Wettlaufer, Albert Wende, J. B. Tyrrell, and Wm. H. Wright. From 90 to 100 men are employed.

The shaft has been continued from the 400 to the 600-foot level, where a station has been cut and crosscutting begun. The following summary of the underground work done in 1920 is taken from the manager's report:

Synopsis of Development

	Feet advanced	Tons hoisted.	
		Waste	Ore.
Drifting	488	150	3,035
Raising	478		717
Shaft-sinking	164	2,143	
Stoping		99	15,574
Total	1,130	2,392	19,326

The 19,326 tons of ore hoisted came from the following sources:

	100 foot level	200 foot level	300 foot level	400 foot level
Drifting	18	577	501	1,939
Raising				717
Stoping	252	3,799	688	10,835
Total tons	270	4,376	1,189	13,491

The broken ore in the stopes amounts to 18,702 tons, having an average value of $28.37 per ton, or a gross value of $520,575.74, against which there are no deferred charges.

The 60-ton mill treated 18,889 tons of ore which yielded $483,701.93 in bullion, an average recovery of $25.61 per ton. From gross profit of $234,992.59 two dividends amounting to $80,000.00 were paid.

Lakeview.—The Lakeview Gold Mines, Limited, owns claims 6780, 6916, 6917, 6918, 8319, 8320, 8324, and 1825 in Maisonville township.

During 1920 camps were built and a plant installed, in addition to considerable surface prospecting. The plant includes two 60-h. p. locomotive type boilers, a 5-drill compressor and a 7 by 10 hoist.

H. N. Darling was in charge of operations.

Lebel Oro.—The Lebel Oro Mines, Limited, capital $1,500,000 in shares of $1.00, owns mining claims 3066, 3067, 3191, 3411, and 3500, totalling 220 acres, in the township of Lebel. The head office of the company is in Room 8, Bank of Toronto Building, Toronto. The officers are: J. Bogert Bartram, president; W. R. Wadsworth, treasurer; Ralph Hurd, manager; and the directors are: J. Bogert Bartram, W. R. Wadsworth, Albert J. Bolton, William F. Greene, Walter E. Hurd, George A. Irwin, and William J. Yeoell.

After building a bunkhouse, a cookhouse, an office and a smithy in the summer, surface stripping and test pitting were done. Later a two-compartment shaft was started and had reached a depth of 30 feet at the beginning of February, 1921. From six to eight men were employed.

Ontario-Kirkland.—Ontario-Kirkland Gold Mines, Limited, was incorporated Sept. 18, 1917, with $1,500,000 capital stock and has been working since on the Hurd claims, L. 2678 and L. 2679, in Teck township. The directors of the company are: Frank Huth, Nazareth, Pa., president;William H. Meyer, Philadelphia, Pa., vice-president; A. J. Bolton, Philadelphia, Pa., treasurer; Walter E. Hurd, Philadelphia, Pa.,; William J. Yeoell, Philadelphia, Pa.,; M. Y. Crauss, Palm, Pa.; W. A. Gordon, Haileybury, Ont., is secretary, and Ralph Hurd, Kirkland Lake, is manager.

In 1920 the shaft, which is on claim L. 2679, was continued from the 300 to the 450-foot level. About 2500 feet of drifting and crosscutting was done on the 300 and 450-foot levels. Some work was also done to prepare the foundation for a 100-ton mill. About 20 men were employed.

Shafthouse, Ontario-Kirkland Gold Mines, Ltd.

Orr.—The Orr, or Orr-Wettlaufer claim, No. T. 16,626 was worked from 1917 to June, 1920, by Kirkland-Porphyry Gold Mines, Limited, under option. In 1920 it was worked from Aug. 4 to Dec. 10 by the Orr Gold Mines, Limited, of which the directors are: Conrad E. Wettlaufer, Buffalo, N. Y.; Hamilton B. Wills, Toronto; William J. Magavern, 54 Erie Savings Bank Building, Buffalo, N. Y.

The shaft on the claim is 420 feet deep; levels have been opened at 150 238, 280, and, 400 feet, and considerable lateral work done. The progress in 1920 consisted of 284 feet of drifting on the 238-foot level and 270 feet of crosscutting on the 400 foot. Thirteen men were employed by the contractor, Victor Bush.

J. C. Houston is manager of the mine.

Teck-Hughes.—Teck-Hughes Gold Mines, Limited, operated the Teck-Hughes mine at Kirkland Lake continuously in 1920 and did 1,509 feet of development work.

The mill operated for 335 days and treated 30,646 tons of ore, which yielded $247,757.04 worth of bullion.

D. L. H. Forbes is manager.

Wood-Kirkland.—Wood-Kirkland Gold Mines, Limited, was incorporated December 24, 1919, with $2,000,000 of capital stock in shares of $1.00 par value. The company owns mining claims L. 6406, L. 7127, L. 7477, L. 7478, and L. 7479, in all 296 acres, situated south of Mud lake in the township of Lebel. The di-

rectors are: George W. Morris, Buffalo, N. Y., president; N. W. Kirkpatrick Dayton, Ohio, vice-president; Fred C. Bonnet, Hamburg, N. Y., treasurer; Henry J. Wood, Buffalo; James E. Day, Toronto; E. L. Wettlaufer, Toronto; A. L. Pfan Terrehaute, Ind.

Work was started in March, 1920, and an office and camps to house 25 men were built. A two-compartment shaft was sunk to a depth of 100 feet and a small amount of drifting done. The machinery consists of a 20 h. p. boiler and a small hoisting engine.

E. B. Wood, Haileybury, is manager, and J. A. Murphy is superintendent. From 10 to 15 men were employed.

Wright-Hargreaves.—Wright-Hargreaves Mines, Limited, was incorporated on June 16, 1916, to work four claims at the east end of Kirkland lake –L. 2103, L. 1829, L. 1830, and L. 1831 (survey numbers,—T. C. 710, T. C. 709, T. C. 708, and T. C. 711, respectively). The officers of the company are: Oliver Cabana, Jr., president; Edwin Lang Miller, vice-president; Gerard F. Miller, secretary-treasurer; Albert Wende, manager; James E. Grant, superintendent. The executive office of the company is at 375-377 Ellicott Square, Buffalo, N. Y.

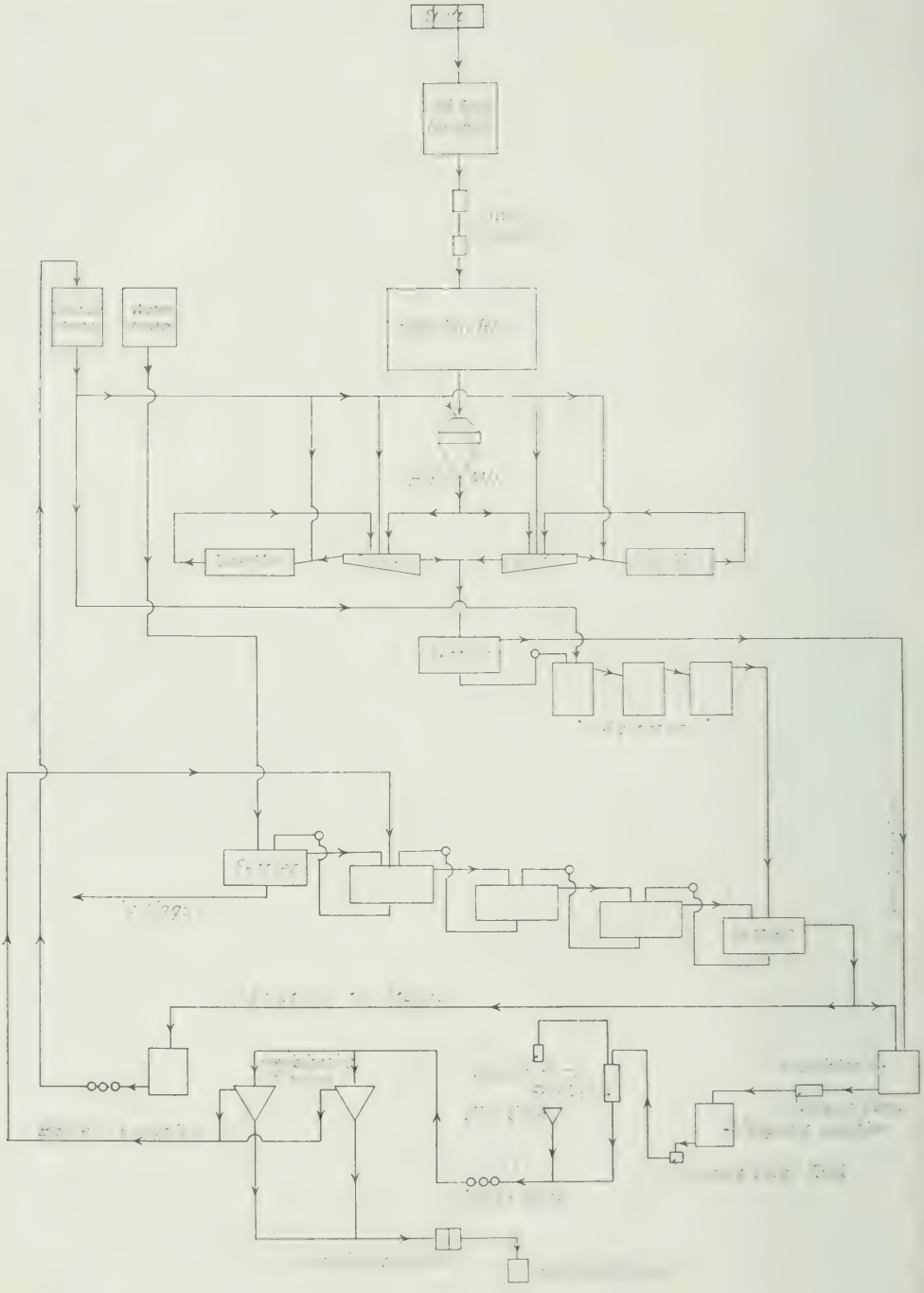
Wright-Hargreaves Mines, Ltd., showing new mill.

The company re-opened the mine in the spring of 1920 and did the following work: sank No. 1 shaft from a depth of 40 to 400 feet; enlarged No. 3 shaft from two to three compartments from the 300-foot level to the surface; on the 300-foot level did 110 feet of drifting; on the 400-foot level did 175 feet of drifting and 110 feet of cross cutting, the latter work being to connect the No. 3 shaft workings with the bottom of the No. 1 shaft.

A 150-ton mill is nearing completion and is expected to be in operation in the spring of 1921.

Larder Lake

Argonaut.—Argonaut Gold, Limited, continued to operate the Argonaut mine formerly known as La Mine D'Or Huronia, in Gauthier township until near the end of the year. The officers of the company now are: J. H. Rainville, president; D. Raymond, vice-president; L. J. Marchand, secretary-treasurer; J. W. Morrison, general superintendent. The capital stock consists of 3,000,000 shares of $1.00 par value, of which 800,000 are retained in the treasury. The head office is at 601 Royal Trust Building, Montreal.



Flow Sheet, Wright-Hargreaves Mines, Ltd.

The following machinery was added to the plant in 1920: a duplex air compresser with a capacity of 732 cubic feet driven by a 100 h. p. motor, a 75 h. p. electrically driven hoisting engine, and an 18-inch by 24-inch Blake jaw crusher.

The shaft was continued from a depth of 179 feet to 380 feet and levels were established at 200 and 350 feet. There were also 851 feet of drifting and 415 feet of crosscutting done.

The mill treated 4,637 tons of ore, of which 1,958 tons came from stopes and the remainder from the development openings. The yield was about $30,000.

The mill closed on October 22, and the mine on December 23.

Associated Goldfields.—Associated Goldfields Mining Company, Limited, has a capitalization of $5,000,000 in $1.00 shares. Of the 4,991,724 shares that have been allotted, 4,257,977 shares are held by Canadian Associated Goldfields, Limited. The latter company was granted letters patent on August 7, 1929, and has an authorized capital of $30,000,000 in $1.00 shares, of which 18,136,294 shares have been subscribed for and allotted. The officers and directors are the same for both companies and are as follows:- president, Dr. George A. MacKay, Toronto; secretary and treasurer, R. William MacKay, Toronto; directors: Dr. George A. MacKay, A. A. McFall, A. Singer, S. B. Gundy, W. H. Despard, all of Toronto; D. H. McCartney, Milton, Ont.; J. Dinwoody, Islington, Ont. The offices are at 306 C. P. R. Building, Toronto.

During the early part of 1920 two rock drills and one diamond drill were at work in the Reddick mine (''Block D''). During the summer only diamond drilling and sampling were being done here.

At the Kerr-Addison property (''Block C'') a three-compartment shaft was started on October 4 and was down 70 feet at the end of the year.

At the Harris-Maxwell (''Block B'') from two to three drills were operated continuously on the 400-foot and 500-foot levels, and some diamond-drilling was also done.

The combined working forces at the first two properties numbered from 25 to 30 men; at the Harris-Maxwell from 60 to 70 men were employed, and in addition 10 or 15 men were engaged in winter in the logging camp.

A. J. Moore is mine manager. All the above properties are at Larder Lake.

Crawford Skead.—Crawford Skead Gold Mines, Limited, head office at Chatham, Ont., was incorporated on December 5, 1919, with a capital of $1,000,000. The company owns two claims in lots 9 and 10, concession V, Skead township, adjoining the Wisconsin-Skead mine on the southwest. A small force was employed at surface work and the building of camps.

Peerless.—The Peerless Gold Mines, Limited, carried on work on their property in McElroy township during most of the year.

During the first half of the year the shaft was continued from a depth of 132 feet to 250 feet, and 400 feet of drifting was done on the 400-foot. The working force during that period averaged about 35 men and was in charge of superintendent A. D. McPhee. After a shut-down of a month 20 men were put to work under John McDonald as superintendent, and an incline shaft was sunk on No. 3 vein to a depth of 100 feet.

On November 30, 1920, the company went into liquidation, and all work was stopped.

Skead.—Skead Gold Mines, Limited, was incorporated on October 9, 1919, with an authorized capital of $5,000,000 in shares of $1.00 par value. The company has acquired 55 mining claims, the two main groups being in lots 2 to 8 in the fourth concession of Skead township. Work was started in the spring of 1920 on these two groups, which are in the vicinity of St. Anthony lake in Skead township; about 20 men were employed.

On the group of claims east of St. Anthony lake a camp to house 40 men, a storehouse, an office, and a boathouse were built. Eight test pits were sunk to an average depth of about ten feet, about 4,000 cubic yards of soil removed in trenching and stripping.

The officers of the company are: Dalton McCarthy Gilpin, president; Louis C. Park, vice-president; James Brebner, treasurer; H. J. Bolitho, secretary; all of Toronto. C. William Evans is manager, and M. L. Bouzan, superintendent.

Wisconsin-Skead.—Wisconsin-Skead Mines, Limited, incorporated August 27 1917 with $2,000,000 capitalization, has property in lot 10, concession V, and lot 10, concession VI, Skead township.

Work was resumed on May 4 and was continued for three months with a force of 20 men.

The company's office is at Ashland, Wis. William Reinhardt is mine manager.

Porcupine

Beaumont.—The Beaumont Gold Mines, Limited, capital $2,000,000 in shares of $1.00 par value, owns mining claims 12,765, 12,868, and 6,039 in lots 2 and 3, concession VI, Tisdale township. The last-mentioned claim was formerly known as the North Davidson mine. The officers of the company are: R. T. Jeffrey, president; L. K. File, vice-president; L. G. Harris, secretary and general manager. The head office is at 601 Royal Bank Building, Toronto.

The following buildings were erected: power house, 30 feet by 24 feet; two-story office, 22 feet by 24 feet; two-story bunk house, 24 feet by 30 feet; dining camp, 24 feet by 30 feet; smithy 18 feet by 26 feet; and change house, 12 feet by 14 feet. Preparatory to letting a contract for sinking a shaft, a 40 h. p. and an 85 h. p. boiler, a four-drill Rand duplex cross-compound air compressor, and an 8-inch by 10-inch hoisting engine were provided.

Sinking was started on May 1, 1920 and the shaft was 54 feet deep in October

Clifton-Porcupine.—Clifton Porcupine Mines, Limited, was incorporated on April 5, 1919, with a capitalization of $2,000,000 in shares of $1.00 par value, to work a 40-acre property in Deloro township. The directors are: F. C. Preston, Midland, Ont., president; Homer L. Gibson, Toronto, vice-president; James Cowan, Toronto; W. E. Preston, Midland, Ont.; W. C. Offer, South Porcupine, Ont. The head office is at 703 Bank of Hamilton Building, Toronto.

This company continued to work during the first half of 1920 and had 20 men employed. After deepening the incline shaft to 228 feet, a small amount of drifting was done on the second, or 196-foot level.

Davidson.—Davidson Consolidated Gold Mines, Limited, was incorporated on July 15, 1919, with a capitalization of $5,000,000. The new comapny took over the assets of Davidson Gold Mines, Limited, and continued to work the Davidson mine for the first five months of 1920. The officers are: C. G. Crean, president; H. H. Sutherland, vice-president and managing director; L. C. Platt, secretary-treasurer; N. J. Evered, South Porcupine, Ont., manager.

Development work done consisted of 380 feet of drifting and 316 feet of crosscutting; 346 feet of the drifting and 271 feet of the crosscutting were done on the 500-foot level. A total of 1,188 feet of diamond drill holes

In the five months the mill treated 3,003 tons of ore from which the recovery was $11,210.30.

Dome.—The Dome Mines Company, Limited, has an authorized capital of $5,000,000 in shares of $10.00 par value. Of this stock $4,706,110 has been issued, $60,560 has been allotted, but is not yet issued, and $233,330 remains in the treasury. The increase of $766,670 in the amount of stock issued was occasioned by the purchase of the Dome Extension property in September.

The executive officers of the company are: J. S. Bache, New York, president and treasurer; W. S. Edwards, Chicago, vice-president; H. P. DePencier, South Porcupine, Ont., vice-president and general manager; Alex Fasken, Toronto, secretary; Alfred H. Curtis, New York, asst. treasurer and asst. secretary. The directors are as follows: J. S. Bache, New York; W. S. Edwards, Chicago; Alex. Fasken, Toronto; G. C. Miller, Buffalo, N.Y.; A. H. Curtis, New York; Colgate Hoyt, New York; T. R. Finucane, Rochester, N. Y.; C. D. Kaeding, South Porcupine, Ont.; Howard Poillon, New York. The head office is at 36 Toronto St., Toronto, and the executive and financial office at 42 Broadway, New York. The fiscal year of the company ends on March 31.

The net excess of current assets over current liabilities now amounts to $1,539,161.27.

The option to purchase the Dome Extension property was exercised by the Dome Mines Company, Limited, and this action was ratified unanimously by the Dome shareholders at a meeting held on September 4, 1920.

Four dividends of 2½ per cent were paid during the year: Nos. 10 and 11, $100,000.00 each, and Nos. 12 and 13, $119,166.75 each, making a total distribution of $438,333.50.

The following information is summarized from the annual report of general manager DePencier:

The operating account for the year ending March 31, 1921, shows:

Revenue from bullion	$	1,946,403 06
Expenditures		
Mining, including hoisting	$	343,774 40
Development	$	253,167 97
Crushing and conveying	$	58,641 08
Milling	$	427,723 72
Administration expense, general and executive offices	$	120,061 67
Provincial and municipal taxes	$	14,341 16
Insurance	$	21,798 69
Total operating costs	$	1,239,508 69
Net operating earnings	$	706,894 37

The net profit for the year was $302,479.89.

Development and Mining—During the year a total of 289,789 tons of ore and rock were hoisted; of this 273,700 were ore which was sent to the mill and treated; and 16,089 tons were waste; of the ore milled, 257,657 tons came from the stopes and averaged $7.58 per ton, and 16,043 tons came from development and averaged $6.30 per ton. No ore was drawn from the Dome Extension mine during the year.

Stoping and development have been carried on at the 5th, 6th, 7th, 8th and 10th levels. The shortage of labour and power again necessitated drawing on the broken ore reserve to the extent of about 50,000 tons. The broken ore reserve now stands at a little over 200,000 tons.

The most important development work of the year has been done at the 10th level. Here, during the first six months of the year, an endeavour was made to locate sufficient ore to warrant the exercising of the Dome Extension option, and, on account of the shortage of underground labour, the work had to be carried on mainly by diamond drilling. This drilling indicated an orebody to which the number 1012 has been given; this body dips north and rakes eastward into the Dome Extension. Further drilling showed that another orebody lies to the south of the former one; this is called the 1020 orebody. The shortage of labour prevented the opening up of these bodies until the latter months of the year.

The 1012 orebody has been opened up for a length of 360 feet. The ore closely resembles the ore in the large hanging wall orebodies of the Dome and consists of a mixture of well mineralized schist and small quartz veins and veinlets. These veins of quartz are irregularly distributed and are not continuous. Some of them roughly conform to the dip and strike of the orebody; others lie at angles and penetrate the walls of the main orebody. The walls are not well-defined and, owing to the presence of these cross veins and bunches of mineralized schist, will only be determined by the gold content of the rock. In addition to very rich pyrite, there is some visible gold present. The rich pyrite is well crystallized, fine, and loosely held in the schist. These facts, together with the presence of visible gold, render the sampling of these drifts difficult and unreliable. For example, the moil sampling of the 360 feet of the 1012 orebody drift, including all high assays, shows an average of $26.00; this does not represent the average grade of ore that can be expected to be mined from this orebody for the reasons mentioned above, namely, the presence of visible gold, the loosely held rich pyrite, and also for the reason that the drift is in the footwall portion of the orebody, which is known to be the richer; further, the presence of bunches of mineralized schist and small cross veins of quartz beyond the margin of the main oreshoot will undoubtedly lead to dilution in mining. A small stope sill has been cut out at the eastern end of the 1012 orebody, and from the results obtained in this work a grade of from $10 to $12 per ton is anticipated for this orebody. The width disclosed in this sill is about 22 feet on an average.

The 1020 orebody lies 80 feet south of the 1012, has approximately the same strike and dip, but is more irregular in mineral content. There is some pyrite and copper mineral present. It contains visible gold and the moil sampling is unreliable. It is expected that ore of good payable grade will be mined here. This orebody has been drifted in for 110 feet.

In addition, on the 10th level, the ore and waste pockets have been cut and put in use, a small pump chamber and sump have also been completed, and a three-throw pump installed which lifts to the main pumping plant at the 8th level.

The development work for the year 1920-1921 is summarized below:

Summary of Development Work for Year 1920-1921.

Level	Drifts	Cross Cuts	Raises	Box Holes	Miscellaneous	Pockets	Total	Diamond Drilling
Dome Mines								
5th	162	541	153	72	.....	.....	928	.....
6th	.....	122	150	29	.....	.....	301	350,00
7th	283	152	414	213	.....	.....	1,062	1,182.20
8th	339	608	560	135	8	.....	1,650	4,307.50
10th	713	1,010	32	101	57	53	1,966	3,865.26
	1,497	2,433	1,309	550	65	53	5,907	9,704.96
Dome Extension								
6th	6	60	10	.....	.....	.....	76	575.5
10th	.....	9	8	.....	.....	.....	17	3,488.3
	6	69	18	.....	.....	.....	93	4,063.8
Totals	1,503	2,502	1,327	550	65	53	6,000	13,768.76

Waste hoisted, 16,089 tons.

Dome Extension Development:—At the 6th level only a small amount of crosscutting and diamond drilling was done in the ore zone during the past year under the terms of the option held by the Dome. This diamond drilling gave results of the same general character as those reported for this territory in last year's report. The work done to date has shown the existence of a large amount of low grade ore from which a profit can only be won under normal operating conditions as regards costs. The work done at the 10th level proves that the ore-bearing formations extend into the Dome Extension.

Ore Reserves:—In the 9th annual report of the company, covering the year 1919-1920, the following remarks regarding ore reserves appeared:

"Experience with stoping and developing the orebodies in the Dome has demonstrated conclusively the futility of attempting to accurately estimate their tonnage and value in the conventional manner on account of the irregularity of their form, and the extremely erratic distribution of gold in them. For the past seven years an earnest effort has been made to make these estimates and an immense amount of engineering data has been accumulated and worked up each year, but in the final analysis an intimate knowledge of the mine, together with the figures for the past actual performance of ore-bearing zones, and the condition of existing exposures of ore have to be more heavily drawn upon than the accurately assembled sampling and surveying data.

"We feel, therefore, that a sounder forecast of the future life and earning power of the property can be given by not attempting to be specific in the matter of ore tonnage and value, but that we should confine ourselves to a broad statement based on a wide review of all the data available. We propose, therefore, to confine ourselves to stating that your property contains ore reserves at the present time sufficient to enable us to continue operating at the full capacity of your plant for a period of three to four years."

On this subject the 10th annual report of the company says:

"The futility of endeavouring to accurately estimate the tonnage and value of ore bodies in the Dome in the conventional manner was dwelt upon in last year's report, and our experience during the past year fully confirms the views laid down at that time. From our knowledge and experience of the mine it is our belief that the limited amount of development work, which under the conditions it has been possible to accomplish, has exposed ore equivalent in value to that milled during the past year. In this connection we regard the developments on the 10th level of extreme importance, as they prove the occurrence of highly-payable ore at the lowest level opened up, and under normal operating conditions ensure the maintenance of the earning power of the mine at a figure comparable with past performance.

"It is hoped that further development of the orebodies intersected in our deeper levels may prove them to be more regular in form and gold content than those in the upper workings, and that, therefore, it will be possible to estimate their value more definitely."

Mill:—The following are the treatment results from the operation of the mill during the year:

		Per Ton	Per Cent.
Heads, 273,700 tons	.....	$7.507	.....
Amalgamation Bullion	$1,221,875.88	4.464	59.467
Cyanidation Bullion	724,527.18	2.647	35.261
Total Recovery	$1,946,403.06	$7.111	94.728

The total expenditure in milling was $427,723.72 or $1.563 per ton milled. This compares with a cost of $1.153 per ton milled during the previous year, the increase being due to increased wage rates, cost of supplies and the greatly increased cost of power during more than three months of the year when we had to operate our steam plant.

During the year, improvements have been made in our grinding equipment which will result in an improved recovery. The recovery for the past year was 94.728% as compared with 94.295% a year ago. Two additional Pachuca tanks have been erected at a cost of $16,837.89 in an extension built for the purpose and will be put into operation in April. These additional agitators together with improvements in the grinding will, it is expected, enable us to maintain our recovery when treating a greater tonnage of the higher grade and probably somewhat more refractory ore from the deeper levels of the mine, at the figure which was established on the lower grade ore for which the Mill was planned when the extensions were made some years ago.

General:—Operating costs show an increase of $1.08 per ton milled over last year, thus reflecting the conditions under which we have been compelled to operate. They also include an increased charge of 92.5c. per ton milled for development as against 52c. last year.

During the year an increase of about 50c. per shift was granted to employees in an endeavor to attract more labor. Also the 8-hour day was inaugurated in all departments. Another large dormitory building, capable of housing over 100 men, was erected at a cost of $35,966.16. A new hospital building, to replace the old one which was destroyed by fire, is nearing completion. The loss was fully covered by insurance.

Practically throughout the year, the cost of materials used in our business has remained at very high figures, this being due in part to the high freight rates in effect. It is only recently that prices have begun to fall materially.

The shortage of power which developed in November, took us entirely by surprise, as we had always been given to understand that there was ample water storage to tide over any dry season. At present, we are receiving sufficient power for our operations, and we are assured by the power company that such steps will be taken this summer as will assure a more adequate water supply in the future.

An ample supply of labour for our operations is now available.

Dome Lake.—The Dome Lake Mining and Milling Company, Limited, worked the Dome Lake mine at Porcupine for the first five months of the year. The company is capitalized at $3,000,000, divided into shares of $1.00 par value and has its head office at New Liskeard, Ont. The officers are: A. A. McKelvie, president; Wm. H. Kinch, vice-president; F. L. Hutchinson, secretary-treasurer.

There were driven during the five months 70 feet of drifts and 39 feet of crosscuts, all on the 600-foot level on vein No. 3. This makes the lateral work done to date in this mine 10,833 feet of drifting and 4,326 feet of crosscutting.

All ore broken was milled before the mine was shut down; this amounted to 5,336 tons, of which 2,234 tons were on hand on January 1, 1920. The ore treated had an average value of $9.73 per ton, or a total value of $51,919.28. From it were obtained 2,264.4 ounces of fine gold and 334.2 ounces of fine silver, for which the company received $47,023.69. The extraction, therefore, was 90.5%, a great improvement over that of the previous year. The mining costs were $29,678.14, and the milling costs $16,270.00.

D. M. McPhail was manager, and 45 men were employed.

Hollinger.—Hollinger Consolidated Gold Mines, Limited, has an authorized capital of $25,000,000. On January 1, 1921, there were outstanding 4,920,000 shares of $5.00 par value. The directors of the company are: president, Noah A. Timmins, Montreal; vice-president and treasurer, David A. Dunlap, Toronto; secretary, John B. Holden, Toronto; L. H. Timmins, Jules R. Timmins, Dr. Wilfred L. McDougald, all of Montreal. The general manager is A. F. Brigham, Timmins, Ont. The general office of the company is at 85 Bay Street, Toronto, and the head office is at Timmins.

The general manager's report for the year ending December 31, 1920, shows a total income of $7,162,611.13; of this amount the bullion produced yielded $6,939,628.43 and other sources $222,982.70. Working expenses absorbed $3,144,328.73, taxes $225,940.81, depreciation and donations $1,343,007.47, leaving a net profit of $2,675,274.93. Nine dividends of one per cent each, amounting in all to $2,214,000.00, were paid during the year, and the sum of $461,274.93 was added to the surplus, which now amounts to $3,131,852.01.

The new hospital was completed during the year. Including the equipment, the total cost was $103,212.15. This building is modern in every detail, and was designed to accommodate 35 patients, including maternity cases.

The money advanced to the Hollinger Stores, Limited, for the purchase and operation of the stores was transferred to capital assets and written down to $40,002.

Marked decreases in the labour supply and the consequent low tonnage necessitated the milling of a better grade of ore, than would otherwise have been handled. The net yield was $9.56 per ton, as compared with $9.40 for 1919.

Power shortage since the autumn has caused considerable curtailment of production and the operation of the auxiliary steam plant will add materially to the cost of operations during the winter months. The capacity of the company's connected apparatus is about 7,500 k. w., and the power company was able to supply only 1,700 k.w. during the winter.

The following information taken from the report summarizes the result of the years' operations:

Cost Data

Sundries		Labour	Stores	Total	Per Ton of Ore
Total General Charges	$79,633.52	$182,417.08	$80,083.07	$342,133.67	$0.5262
Total Mining Charges		1,192,326.14	658,720.78	1,851,046.92	2.8469
Total Milling Charges		335,401.24	615,746.90	951,148.14	1.4628
Grand Total	$79,633.52	$1,710,144.46	$1,354,550.75	$3,144,328.73	$4.8359

Underground haulage, Hollinger mine, showing electric trolley locomotive drawing a train of ore cars.

Ore Reserves

A complete recalculation of the tonnages and values of all veins, based upon new and more accurate data, discloses material improvement in the gold content. Labour shortage has resulted in confining our efforts to the development of the better grades of ore.

Increases in wages and the continued high prices of mining supplies have determined the policy of deleting all ore of $6.00 or less per ton. The tonnage formerly reported in the statement of surface outcrops is similarly treated. This does not mean that we consider them valueless, but, keeping in mind the present disabilities under which gold mining is being carried on, we feel that these items should not be included in a conservative statement.

	Tons	Value per ton	Estimated gross value Dec. 31, 1920.	Estimated gross value Dec. 31, 1919.
TOTAL ORE RESERVES, (DEVELOPED UNDERGROUND).				
Above 425-foot level	1,433,409	$10.71	$15,354,779	
Above 800-foot level	1,629,753	11.61	18,933,784	
Below 800-foot level	230,843	9.99	2,307,496	
	3,294,005	11.11	36, 596,059	$37,693,450
PROBABLE ORE.				
Veins under $6.00	585,078	5.36	3,135,731	157,200
Surface outcrops	208,000	9.55	1,987,880	2,077,780
Grand total	4,087,083	10.20	$41,719,670	$39,928,430

Diamond drill, Hollinger mine. Note the character of the ore body.

Another summary of the ore reserves developed underground shows the same total as above but the classification is different:—

	Tons	Value per ton	Estimated gross value Dec. 31, 1920	Estimated gross value Dec. 31, 1919
Veins over $10.00	1,394,453	$14.02	$19,547,832	$18,291,480
Veins $10.00 to $8.00	1,748,456	9.09	15,904,110	18,099,650
Veins $8.00 to $6.00	151,096	7.57	1,144,117	1,302,320
Totals	3,294,005	$11.11	$36,596,059	$37,693,450

Operations in Plant and Development Accounts

Showing expenditures by companies now comprised in Hollinger Consolidated Gold Mines, Ltd.

Year	Plant		Development	
	Expended	Written off	Expended	Written off
1910-1915	$1,839,910.05	$529,480.89	$1,155,644.67	$379,346.37
1916	599,417.16	150,000.00	125,593.32	
1917	673,237.52	100,000.00	131,224.23	
1918	118,379.14	375,000.00	5,006.54	
1919	338,162.32	600,000.00		629,872.39
1920	131,359.78	445,985.08		408,250.00
Totals	$3,700,465.97	$2,200,465.97	$1,417,468.76	$1,417,468.76

The present valuation of $1,500,000.00 for plant is 40.5 per cent. of the total cost.

Employees

Average number of men during the year has been 1,025, distributed as follows:

Miners		Mechanics		General		Totals	
Exploration	11	Operation	49	Mill & Refinery	136	Miners	629
Development	138	Maintenance	80	Engineering Staff	29	Mechanics	138
Production	480	Construction	9	Clerical Staff	24	General	258
				Miscellaneous	69		
	629		138		258		1,025

Milling Results

Tons Ore Milled		650,205
Average Value Per Ton	$	9 93
Gross Value	$	6,456,623 28
1,156 Tons Old Concentrates	$	9,708 52
Total Gross Value	$	6,466,331 80
Deduct Loss in Tailings		246,667 00
Net Value Recovered		$6,219,664 80

Average tons per day	1,777	Cyanide consumed per ton of ore	0.532 lbs.
Per cent. of possible time run	53.8	Zinc consumed per ton of ore	0.449 lbs.
Tons per 24 hours running time	3.303	Zinc consumed per ton of solution	0.178 lbs.
Stamp duty per 24 hours running time	14.68	Lime consumed per ton of ore	2.871 lbs.
Tons solution precipitated per ton ore	2.52	Lead acetate per ton of ore	0.034 lbs.
Value per ton in tailings	$0.38	Average value pregnant solution	$3.80

Mine Development

Progress during the year was as follows:

Level	Shafts	Drifts	Cross Cuts	Raises	Diamond Drilling	Timbering		Excavation
						Shafts	Stopes	
	feet	feet	feet	feet	feet	feet	feet	tons
100 feet				121	4,250			
200 feet		907	245	8	2,710		497	452
300 feet		1,693	468	79	6,923		77	210
425 feet		909	342	21	5,202		571	420
550 feet		2,655	2,601		8,117		2,796	390
675 feet		1,622	3,099		2,788		23	185
800 feet		1,280	1,129	20	9,603		396	
950 feet			276					
1,100 feet			326					145
1,250 feet	5					20		410
1,450 feet	150					150		535
1,550 feet	147				602	132		
Totals	302	9,066	8,486	249	40,195	302	4,360	2,747

Total Sinking, Drifting, Cross-Cutting and Raising: 18,103 feet.

Hospital at Timmins, erected in 1920 by the Hollinger Consolidated Mines, Ltd.

Mine Production

Level	Broken Ore in Mine Jan. 1, 1920	Ore Broken During 1920	Ore Removed During 1920	Broken Ore in Mine Dec. 31, 1920
No. 10 Shaft Dump	2,250			2,250
No. 11 Shaft Dump	1,490		1,490	
Above 100 ft. Level	895	5,292	6,187	
" 200 ft. Level	65,620	126,074	135,598	56,096
" 300 ft. Level	37,404	86,483	89,623	34,264
" 425 ft. Level	162,799	69,655	154,738	77,716
" 550 ft. Level	76,018	378,618	221,728	232,908
" 675 ft. Level		23,818	23,158	660
" 800 ft. Level	480	15,966	16,355	91
" 950 ft. Level		91	91	
" 1,100 ft. Level		45	45	
Totals	346,956	706,042	649,013	403,985

Fault, No. 91 vein, 425-ft. level, Hollinger mine.

Keora.—Porcupine Keora Mining Company, Limited, was incorporated on April 6, 1911, with a capitalization of $2,000,000 to work four claims in lot 6 and one in lot 5 of the fifth concession of Whitney township. The officers of the company now are: W. B. Gunton, Confederation Life Building, Toronto, president; William Smith, secretary-treasurer; J. C. Waite, manager.

During 1920 the main shaft was sunk from a depth of 120 feet to 250 feet, and a crosscut was started. This crosscut entered the vein at 465 feet from the shaft about the end of January, 1921.

McIntyre.—McIntyre Porcupine Mines, Limited, with mines and mill at Schumacher, Ont., has an authorized capitalization of $4,000,000; this is divided into shares of $1.00 par value, of which 3,640,283 shares have been issued. The officers of the company are: president, J. P. Bickell, Toronto; vice-president, Henry M. Pellatt, Toronto; secretary-treasurer, M. P. Van der Voort, Toronto; assistant-secretary, L. J. Pashler, Toronto; general manager, R. J. Ennis, Schumacher, Ont.; mine superintendent, J. E. McAllister, Schumacher, Ont.; mill superintendent, A. Dorfman, Schumacher, Ont. The board of directors consists of: the president; the vice-president; W. J. Sheppard, Waubaushene, Ont.; J. B. Tudhope, M. P., Orillia, Ont.; N. S. Dunlop, Montreal. The head office is in the Standard Bank Building, Toronto.

The following information is taken from the eighth annual report of the company, which covers the fiscal year ending June 30, 1920:

Net operating earnings amounted to $1,051,404.13 and non-operating earnings to $228,828.24, making a total of $1,280,232.37 earned during the year as compared with $839,588.62 during the previous year. Of this amount $462,211.54 was appropriated as follows:—

Plant depreciation	$180,213.76
Written off securities to bring these to present market price	25,000.00
Expenditures for development work and interests acquired in adjoining properties	204,427.80
Amount reserved for taxes accrued for the current year	52,569.98

This left a net profit of $818,020.83.

During the year three dividends of five per cent each, aggregating $546,042.45, were paid to shareholders. Surplus at June 30, 1920, amounted to $1,381,683.98.

The production since the commencement of milling operations in 1912 is tabulated below:

Date	Period	Tons Milled	Value Per Ton	Gross Value	Recovery	
					Per Ton	Total
1912	12 Months	14,500	$ 7.00	$ 101,555.16	$5.25	$ 76,166.38
1913	12 Months	31,979	7.85	251,314.45	7.05	225,752.25
Jan. 1-14 to Mar. 31-15	15 Months	85,654	8.87	760,232.16	8.39	718,331.71
April 1-15 to Mar. 31-16	12 Months	105,758	7.71	815,345.49	7.38	779,990.94
April 1-16 to June 30-17	15 Months	195,307	10.00	1,954,793.28	9.55	1,864,914.28
July 1-17 to June 30-18	12 Months	178,327	10.05	1,793,197.55	9.61	1,714,258.00
July 1-18 to June 30-19	12 Months	179,874	9.78	1,759,627.40	9.29	1,671,646.03
July 1-19 to June 30-20	12 Months	188,835	11.52	2,175,891.31	11.02	2,080,188.44
		980,234	$9.80	$9,611,956.80	$9.32	$9,131,248.03

The bullion recovered during the year contained 99,461.39 ounces of gold and 21,140.3 ounces of silver and was valued at $2,080,188.44, or $11.02 per ton of ore treated.

A total of 262,512 tons of ore was mined in the No. 5 and Main shaft workings, and 190,403 tons of this was hoisted, 72,109 tons remaining broken in the stope. No ore was mined in the Jupiter workings, but the shaft was used during the first four months of the year to explore the Plenaurum property from the 1000-foot level.

Summary of Ore Hoisted.

Level	Tons	Assay	Value
600	7,742	$ 6.85	$ 52,846.00
700	2,929	9.30	27,207.00
800	33,986	13.25	450,335.00
900-1,000	63,883	10.02	640,524.00
1,125	77,705	12.09	939,380.00
1,250	2,335	13.60	31,745.00
1,375	1,115	10.40	11,594.00
1,500	138	9.90	1,368.00
Shaft	570	12.55	7,147.00
	190,403	11.55	$2,162,146.00

Development and Exploration

The limited number of workmen available for development work have been employed in opening up the 1125, 1250 and 1375-foot levels. The Main shaft was put down from 1400 to 1560 feet and levels cut at 1250,1375 and 1560 feet. Ore and waste pockets were cut at 1375 and loading boxes installed. An ore pass was raised through to the 1250 and is being continued to the 1125; when it is completed, all the ore from these levels will drop directly to the ore pocket on the 1375-foot level.

At 1490 feet the main shaft encountered an ore body and continued in it for 50 feet; this ore body was exposed in the station on the 1500-foot level and is 12 feet wide, assaying $10.20. The 1500-foot station also crosscut No. 5 vein 50 feet south of the shaft; this shows 10 feet of ore assaying $13.00.

For some time the important influence of the quartz porphyry upon the ore bodies found in the Pearl lake section has been recognized, and it has been considered as highly probable that new ore bodies would be found below the 1000-foot horizon. Accordingly diamond drilling was carried from each new level to obtain geological data and to prospect the mineralized area on the north contact. The results have finally been successful and a drill hole bearing S. 20 degrees W. at an angle of 15 degrees downward from the 1500-foot level intersected an ore body 530 feet from the main shaft at a depth of 1610 feet from the surface; 35 feet of core assayed $11.10. A hole was then drilled from the 1375-foot level at an angle of 5 degrees and with a bearing S. 20 degrees E.; at 480 feet this hole intersected the same ore body at a depth of 1385 feet from the surface and 26 feet of the core assayed $14.10. Crosscuts are now being driven south from the 1375 and 1500-foot levels to open up this new ore body.

Summary of Development and Exploration Work

	Drifts feet	Cross-Cuts feet	Raises feet	Winzes feet	Shafts feet	Stations feet	Sump tons	Pockets tons	Footage Total	Total Tons Excav.	Diamond Drilling
July 1, 1919 to June 30 1920	3,196.7	372.0	765.0	.....	298.0	177.0	.....	2,136.0	4,808.7	2,136.0	4,538.0
Prior to June 30, 1919.	32,045.1	13,414.3	5,412.4	579.7	5,342.1	1,171.0	2,402	1,100.0	57,964.6	3,502.0	36,317.6
Total to June 30, 1920.	35,241.8	13,786.3	6,177.4	579.7	5,640.1	1,348.0	2,402	3,236.0	62,773.3	5,638.0	40,855.6

Operating Costs

The total operating costs per ton milled amounted to $5.4844. Mining costs totalled $3.0557 and are made up of: breaking and stoping $2.2421, development $0.7715, and exploration $0.0421. The more important of the remaining items are: milling $1.0449; head office expense $0.3369; mine office expense $0.2777; heating and maintenance—buildings and camps $0.2334; crushing and transportation of ore $0.2273. Operating costs show an increase of 40c. per ton over last year, mainly caused by an increase in the cost of labour.

Estimated Ore Reserves

In the following estimate of ore reserves ample allowance has been made for the reduction of values due to barren schist inclusions in the vein and dilution of broken ore by wall rock.

	Tons	Assay	Amount
Jupiter claim	35,295	$ 7.45	$ 262,947.75
McIntyre and Pearl Lake claims	353,876	11.30	3,998,798.80
Broken ore reserves in stopes	113,511	11.75	1,333,754.25
Totals	502,682	11.13	$5,595,500.80

Milling

The mill operated continuously during the year and treated 188,835 tons of ore at a cost of $1.0449 with an extraction of 95.6%.

The percentage of recovery dropped slightly in the last two periods of the year owing to the premature precipitating action of graphitic schist in the ore broken from development work on the 1250 and 1375-foot levels. Plans are being made to eliminate this graphitic material by means of flotation before treating the ore in cyanide solution. It is expected that the final recovery will be 95.5% of the gold and silver contents of the ore, and that the cost of the additional treatment will not exceed 20 cents per ton; this will make the total milling cost about $1.25 per ton of ore milled.

Porcupine Crown.—The Porcupine Crown Mines, Limited, capital $2,000,000 divided into shares of $1.00 par value, is controlled by the Crown Reserve Mining Company of Cobalt. The officers are: John W. Carson, president and managing director; William I. Gear, 1st vice-president; James G. Ross, 2nd vice-president; James Cooper, secretary-treasurer; John Reid, assistant secretary-treasurer; H. J. Stewart, manager.

Up to February 15 a force of 15 men was employed on development work. It was then decided to resume milling, and the force was increased to 80 men.

On May 15 the property and the plant were transferred to a new company, the Northerown Porcupine Mines, Limited, incorporated under the laws of Ontario with a capitalization of $3,000,000 in shares of $1.00 par value. The new company has also acquired the Porcupine Thompson-Krist property consisting of 120 acres lying immediately south and south-east of the Porcupine Crown claim. In consideration of the transfer of the properties the Porcupine Crown Mines, Limited, received 2,000,000 shares of the Northerown stock; and the Porcupine-Krist Mining Company, 1,000,000 shares.

Up to May 15 the Porcupine Crown milled 6,220 tons of ore, averaging $12.48 per ton; the net value of the production was $74,773.08 which, with exchange, gave a total revenue from production of $83,101.55 From May 15 to December 31 the Northerown Porcupine milled 11,678 tons of ore averaging $8.55 per ton; the net value of the production was $96,458.32, which, with the exchange on bullion cheques, gave a total revenue from production of $107,610.84.

The exploration and development work done consisted of 1,824 feet of drifting and 2,787 feet of diamond drilling.

Work was stopped on the Canadian Kirkland property at Kirkland Lake and the option surrendered.

Union.—The Union Mining Corporation, Limited, owns claims P. 2772, P. 2773, P. 2784, P. 2785, P. 8212, and P. 8213, comprising 195 acres in Whitesides township, and also controls 105 acres of adjoining lands. The property is about 28 miles southwest of Timmins, Ont.

The officers are: H. R. Winton, 76 Adelaide St., Toronto, president; G. Cling, vice-president, Chicago; R. O. Witzke, secretary; C. T. Denker, Timmins, Ont., manager.

The company began work on September 9, 1920, with a force of 25 men. A 24 mile wagon road was cut to the claims, and the following log buildings erected: cook-camp, sleeping-camp, and icehouse, each 20 feet by 35 feet, a power house, 35 feet by 35 feet; a smithy, 15 feet by 20 feet; and a sawmill with a capacity of 5,000 feet per day.

Early in 1921 a mining plant was set up; this includes an 80 h. p. locomotive-type boiler, a 570-cubic-foot straight line air compressor, and an 8-inch by 10-inch Jenckes hoisting engine.

A 75-foot prospecting shaft was sunk on one of these claims in 1913; it is planned to enlarge this and use it as a working shaft.

Matachewan

Thesaurus.—Thesaurus Gold Mines, Limited, owns the Nelson group of claims on the north boundary of Baden township at the head of Matachewan Lake. After considerable trenching, an adit was started late in 1919 and driven 50 feet, and a two-compartment shaft was sunk to a depth of 40 feet. Two log camps, about 14 feet by 16 feet, were built. A small outfit of machinery was purchased but was destroyed by a forest fire at Fox rapids on the Montreal river, while being transported to the property. Six men were employed on the claims under the direction of J. C. Nelson.

West Shiningtree

Atlas.—Atlas Gold Mines, Limited, stopped work on its claims at Wasapika lake early in 1920 and up to the end of the year had not resumed. The shaft on the Evelyn vein is now about 40 feet deep.

The head office address of the company is: in care of Joseph Montgomery, 12 King St. East, Toronto. The directors are: president and managing director, A. M. Bilsky; secretary, Israel Singer, Toronto; John Y. Kendall, Montreal; L. Pincus, New York; J. Samenhof was also on the directorate until his death; his place has not yet been filled.

Herrick.—The Herrick Gold Mines, Limited, owns six claims comprising 275 acres, near the south end of Michiwakenda lake. The company is capitalized at $2,000,000, and the par value of the shares is $1.00. The head office is at 10 King St. East, Toronto and the officers are as follows: president, A. H. Chapin, Springfield, Mass.; secretary-treasurer, E. M. White, Toronto; directors: Dr. J. T. Herrick, Springfield, Mass.; Gordon C. Crean, Toronto; E. A. Snowman, Springfield, Mass.; H. H. Sutherland, Toronto; managing director, F. C. Sutherland, Toronto.

Early in the year 3,000 feet of diamond drilling was completed, and during the summer the two-compartment shaft on claim T. R. S. 4105 was deepened from 50 feet to 125 feet. The annual report of the company dated February 9, 1921, states:

> The main vein, which was perpendicular from the surface down to about 50 feet, dipped out of the shaft to the west at a depth of between 60 and 65 feet. A crosscut was run on the 100-foot level for approximately 40 feet and the vein picked up. About 60 feet of drifting has already been done on this vein and the values obtained have been satisfactory.

The work, which was in charge of F. L. James, was stopped in the fall and up to the time of writing (March, 1921) had not been resumed.

Wasapika.—Wasapika Gold Mines, Limited, has been succeeded by Wasapika Consolidated Mines, Limited, which received letters patent in January, 1920. The capitalization of the new company is $6,000,000, divided into shares of $1.00 par value; 4,282,535 shares have been issued and of these 4,000,000 shares were issued in consideration of the transfer of assets. The shareholders of Wasapika Gold Mines, Limited, received three shares of the new stock for one share of the old.

Since May 26, 1920, no work has been done in the Wasapika mine. On that date the vertical two-compartment shaft was 200 feet; 29 feet of crosscutting had been done on the 200-foot level and 71 feet on the 100-foot. The shaft at this mine is on mining claim T. R. S. 2530; the camps are on T. R. S. 3765.

The directors of the re-organized company are: president, George R. Rogers, Toronto; secretary-treasurer, Elizabeth Lille, Toronto; James E. Way, Reginald E. Hore, L. J. Lahay, W. R. Scott, all of Toronto. The head office is at 1306 Bank of Hamilton Building, Toronto.

White Rock.—White Rock Mining Company, Limited, received an Ontario charter on November 17, 1919, with authority to issue $1,000,000 capital stock in shares of $1.00 par value. The company has issued 500,000 shares to William McVittie and Thos. Saville of Sudbury in consideration of the transfer to the company of mining claims W. D. 1417 and T. R. S. 2535 in the township of MacMurchy, the area involved being 70.7 acres, of which 12.4 acres is under Wasapika lake. The directors all reside in Sudbury and are as follows: William McVittie, president; W. Arthur Evans, vice-president; Charles Jessup; Maurice Cohen; Charles McCrea, M. P. P. A. J. Manley of Sudbury is secretary.

In addition to surface prospecting in 1920, the company built camps and purchased a small steam plant. In the spring of 1921 work was resumed and a two-stamp Tremaine mill bought for experimental purposes.

Howry Creek Area

There are three groups of claims in the Howry Creek area on which work was in progress on April 21, 1921, when inspection was made; these are the Bousquet, the Howry Creek, and the Craig-Pollard claims. The Bousquet and Howry Creek are six and a half or seven miles east of Willisville station (revised railway mileage 65.6 miles from Sudbury) on the Algoma Eastern railway. In summer the trip to these two properties is made by a good water route, consisting of Charlton lake and Howry creek; in winter the ice is used to the east end of Charlton lake, from which point a road has been built to the working properties. The Craig-Pollard claims are near West River station, which is at railway mileage 63.4, and are some eight and a half miles west of the claims mentioned on Howry creek proper.

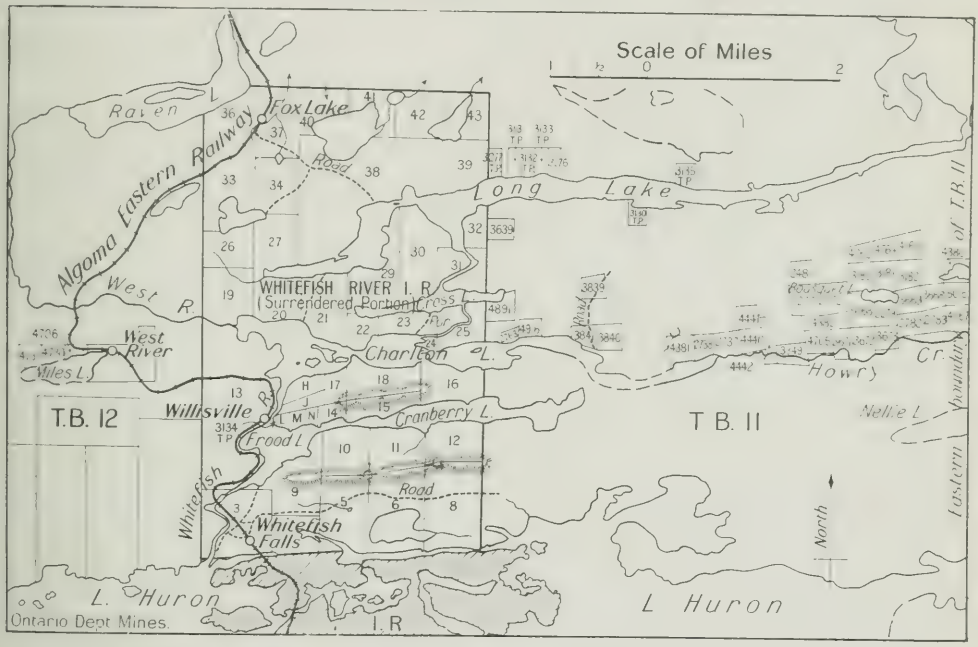
The predominant rock in the area is a quartzite or arkose series; with this quartzite is associated some greywacke and conglomerate. There is also a diorite, which was seen on both the Bousquet and Howry Creek properties and along the railway between Willisville and West River.

Bousquet Gold Mines, Limited.—This company has an authorized capitalization of $2,000,000, and the shares are of $1.00 par value. Its head office is at 6 King Street West, Toronto, and the officers are: president, Harold Tough, Willisville, Ont.; vice-president, Robert R. Tough, Willisville, Ont.; secretary-treasurer, Wm. B. McPherson, Toronto; directors: Thomas Baird Tough, Niagara Falls, Ont., James A. Bousquet, Willisville, Ont.

The holdings of this company consist of ten mining claims—S 2272, S 2277, S 2481, S 3180, S 3181, S 3182, S 4382, S 4599, S 4600, and S 4601—in timber berth No. 11 in the Sudbury mining division.

Gold occurs on claims S 3180 and S 3181 in a belt of grey schist, striking approximately east and west and containing some pebbles. The rock looks like a schistose greywacke. C. W. Knight[1], on examining a specimen of the schist under the microscope, found it exceedingly fine-grained and composed of micaceous minerals and quartz grains; in this fine-grained matrix are quartz grains of larger size. The width of this band of schist was not ascertained, but at one point it is exposed for a horizontal width of 24 feet with no contacts visible. A slope sunk in this schist is said to be 44 feet deep, but as it was nearly full of water, only the upper portion could be examined; this showed the schist to contain narrow veins of quartz and ankerite and to have a dip at the surface of 55 degrees to the north. A two-compartment vertical shaft, measuring 6 feet by 10 feet outside, is now being sunk and on the day inspection was made had reached a depth of 20 feet.

Clean and comfortable buildings, consisting of a sleeping camp, a cook house and a office, have been completed on the claims; these are of lumber covered with "paroid." Near the shaft and incline, which are not far apart, is a combined power-house and blacksmith shop; this building contains a locomotive-type boiler, an Ingersoll-Sergeant-Cooper compressor, and an 8 by 10-inch James Cooper hoisting engine.



an showing Howry Creek area, located in Timber Berth 11, north shore of Lake Huron, district of Sudbury.

The Howrey Creek Mining Corporation, Limited.—This company owns four claims south of the Bousquet Gold Mines' property—S 2279, S 2782, S 2783, and S 3673.

The main vein is about half a mile south of that of the Bousquet, but is of a different type. It occupies an irregular fracture, having a general direction of east and west, and consists of altered quartzite, quartz, ankerite, arsenopyrite, pyrite, and a little chalcopyrite. At one point the width of combined vein matter and schistose quartzite is nearly six feet, but this was the widest place seen. On the whole the vein is narrow.

[1]Associate Provincial Geologist of Ontario.

The vein occurs in quartzite, or arkose. North of the vein and at one point within a hundred feet of it diorite occurs; the contact between the quartzite and diorite is covered by drift but, judging from the topography, it is probably roughly parallel to the vein. This diorite extends through to the Bousquet claims. Mr. Knight kindly made a microscopic examination of a specimen of this rock from the Howrey Creek property and says regarding it: "It is a diorite consisting largely of plagioclase and hornblende; the plagioclase is badly altered to secondary minerals. There are a few micrographic intergrowths of quartz and feldspar."

It is interesting to note that the Long Lake gold mine, now abandoned, lies 25 miles to the northeast of the Bousquet and Howrey Creek groups, and that the orebody was an arkose carrying gold and arsenopyrite and was associated with a diorite.

The Howrey Creek Mining Corporation has sunk several test pits on the vein, the deepest of which is said to be 18 feet. An adit is now being driven N. 20 degrees W. magnetic from the south slope of the ridge on the top of which this vein outcrops. It was 90 feet long on April 21 and a few feet south of the face a vein 18 inches wide had been cut.

Near the portal of the adit a boiler house has been built which also serves as a blacksmith shop. In this building are an Ingersoll Rock Drill Company compressor, 12 inches by 16 inches, and a Nagle 50 h. p. locomotive-type boiler.

Seventeen men are employed by this company. They are temporarily housed on the shore of Howry creek in some log camps that were built by a lumber company.

The capitalization of the company is $1,000,000 and the head office is at 77 Victoria Street, Toronto. The officers are: president and treasurer, Glenn C. Bull, Chicago; vice-president and manager, A. L. Kemp, Willisville, Ont.; directors: Sid A. Erwin, Detroit, Mich.; William Benziger, Chicago; W. A. Werrett, Toronto. The company started mining late in 1920.

It is the intention of the company to produce refined arsenic, as well as gold; with this end in view a second-hand arsenic refining plant has been bought and, with the exception of a rotary kiln that went through the ice on Charlton lake in March, 1921, this machinery is now on the property but is not set up.

Majestic Gold Mines, Limited.—This company was incorporated on January 24, 1921, with a capital of $1,000,000 in $1.00 shares. The head office is at 213 Carlton Street, Toronto, and the directors are: president, M. A. Attalah, Toronto; Saad Lattief, Toronto; secretary, Charles Gregory, Parry Sound, Ont. This company owns patented mining claims in lot 4, concession II, Beatty township, and has a five-year option on six claims in Coulson township, viz., L 6417, L 6418, L 6419, L 6420, L 6421, and L 6422; both these groups are reached from Matheson on the T. and N. O. railway. In April the company began to prospect under option three claims beside the Algoma Eastern railway on the north shore of Miles lake and about half a mile west of West River station; this station is at railway mileage 63.4. These claims are S 4706, recorded in the name of J. G. Pollard, and S 4730 and S 4731, recorded in the name of George Craig;

The vein being tested is in quartzite, or arkose, and has a strike of S 46 degrees E. for 3 chains and N. 68 degrees E. for 8 chains. The vein consists of quartz, white, gray and, in places, almost black. The average width of the vein for this 11 chains is approximately 8 feet; at one point it is 16 feet wide. Not much mineralization is visible on the surface, but in a test pit which was recently started, occasional bunches of pyrite occur.

Seven men were working on these claims under the direction of Peter Greco. A small boiler was in use to supply steam to a plugger drill.

Anthraxolite

Some diamond-drilling was done during 1920 near Larchwood. This is of particular interest in that it gives information regarding the depth of the sedimentary series in the Sudbury basin. Twenty years ago Wm. McVittie of Sudbury, in the hope of finding a seam of coal, put down a vertical diamond-drill hole to a depth of 1,005 feet. This hole is beside the road on the farm of James H. Davey and is in lot 11, concession II, township of Balfour; it is half a mile south of the C. P. R. main line. The Smith and Travers Company were engaged to continue the drilling of this hole. In August, 1920, a depth of 3,007 feet was reached, and work was then stopped as this was the greatest depth at which the drill would work. Information was not obtained as to how much the drill hole deviated from the vertical, but Mr. McVittie states that the core from the bottom consists of sedimentary rocks, that no norite was encountered and that he intends at some future date to continue the hole still farther.

This drilling was done owing to the presence of black slates and carbonaceous matter in the vicinity. The prospect known as the "Gordon coal mine" lies three-quarters of a mile to the south in lot 10, concession 1, Balfour township; this consists of a vein of "anthraxolite" or anthracitic carbon, and was described by Dr. A. P. Coleman in the Sixth Annual Report of the Ontario Bureau of Mines. Although the material will burn, the ash content, chiefly silica, is high.

Silver

Cobalt

Aladdin.—The Chambers-Ferland mines at Cobalt are operated by Aladdin Cobalt Company, Limited. The stock of this company was held by Aladdin Cobalt Company, Limited, London, England, but the latter company has been liquidated and superseded by the Kirkland Lake Proprietary, (1919) Limited, which is also the holding company of the Tough-Oakes Gold Mines, Limited, and Burnside Gold Mines, Limited.

The directors of Kirkland Lake Proprietary reside in London, England, and are: G. R. Bonnard, Chairman; H. G. Latilla; Capt. C. R. E. Jorgensen; General Sir Bindon Blood, G. C. B.; Hon. K. H. Campbell; R. Simpson. The directors of Aladdin Cobalt Company, Limited are: Capt. C. R. E. Jorgensen,; president; Harry B. Sedgwick; G. R. Bonnard. There is also a Canadian advisory board consisting of : Charles A. Richardson, chairman; R. T. Shillington Arthur Ferland; all of Haileybury, Ont. Mr. Richardson is also manager of the company. John Matheson is mine captain and E. S. Gordon, accountant.

In 1920 several veins in the south part of the property were prospected and 1,611 feet of development work was done; this work consisted of 686 feet of drifting, 718 feet of crosscutting, 130 feet of raising, and 77 feet of winze-sinking.

A total of 1,021 tons of ore was sent to the mills and yielded 21,467 ounces of silver.

Beaver.—Owing to the shortage of power and labour in 1920 and the drop in the price of silver from $1.31\frac{3}{4}$ March 1, 1920, to $64\frac{1}{4}$ cents an ounce December 31, 1920, the Beaver directorate closed down the mine on December 21, 1920. The mine is being kept pumped out and operations will be resumed when conditions become normal.

The work done during the year was 890 feet of drifting, 228 feet of crosscutting, 167 feet of raising and 3,603 cubic yards of stoping. The production of silver was 157,274 ounces.

The officers and directors are: F. L. Culver, president; F. C. Finkenstaedt, vice-president; H. E. Tremain, secretary-treasurer; W. E. Stevenson, F. L. Lovelace, William T. Mason, and R. Graham, directors; H. L. Donaldson is mine superintendent.

Cobalt A-53.—The Cobalt A-53 Silver Mining Company, Limited, began work early in 1920 on its property in the Gillies Limit. The officers of the Company are: R. J. Hart, 110 Broadway, New York, president; W. H. Matthews, secretary-treasurer, 18 Toronto Street, Toronto; M. W. Simpson, manager, Haileybury.

The shaft was continued from a depth of 55 feet to nearly 100 feet. A total of about 210 feet of drifting and crosscutting, part of which was done in 1920, has been completed on the 55-foot level. A force of 14 men was employed at intervals during the summer and fall.

The company stopped all work on December 8.

Cobalt Provincial.—The Cobalt Provincial Mining Company, Limited, capitalized at $1,500,000, operated the Provincial mine until August 9, 1920, with a force of 20 men. The officers are: F. G. Logan, Chicago, president; C. L. Painter, St. Louis, Mo., secretary-treasurer; John Reddington, Cobalt, manager.

The work done in the mine in 1920 consisted of : in No. 1 mine, drifting 197 feet, crosscutting 74 feet, raising 40 feet, and stoping 8,600 cubic feet; in No. 2 mine, drifting 62 feet, crosscutting 92 feet, raising 40 feet, and stoping 8,784 cubic feet.

The mill ran 180 days and treated 3,680 tons of ore, averaging 10.65 ounces of silver. The concentrates produced amounted to 66.55 tons with an average silver content of 393.7 ounces per ton, making the average recovery 7.15 ounces.

Colonial.—The Colonial mine is situated on the southwest quarter of the south half of lot 3, concession VI, Coleman township. It is owned by The Colonial Mining Company, Limited, which was incorporated October 19, 1906, with a capital of $100,000 in $1.00 shares. The Colonial Silver Mines, Limited, incorporated under the laws of Maine with a capital of $6,000,000 in shares of $5.00 par value, owns 99,995 shares of the Colonial Mining Company, Limited.

The mine, which has lain idle since 1914, was reopened for two or three months in 1920 and ten men were employed under the supervision of M. W. Hotchkin. Drifting was done on the adit level.

The president of the company is E. G. Germer, Erie, Pa.

Coniagas.—The Coniagas Mines, Limited, was incorporated November 24, 1906, with a capital of $4,000,000, divided into 800,000 shares of $5.00 par value. The company owns and operates the Coniagas mines at Cobalt and the Coniagas Reduction Company's refinery at St. Catharines. The head office is at St. Catharines and the directors are: R. W. Leonard, C. E., president, St. Catharines; Alex. Longwell, vice-president, Toronto; Fraser D. Reid, general manager, Cobalt; A. L. Bishop and Welland D. Woodruff, St. Catharines; R. L. Peek, Deschênes, Que.; R. P. Rogers, Cobalt.

The following is taken from the annual report of the company for the year ending October 31, 1920:

The Coniagas Reduction Company's plant was in operation for 70% of the possible time during the year, treated 1289 tons (dry weight) of ore, and shipped 896,356 ounces of fine silver. The average number of men employed was 94. A dividend of $100,000, payable on November 1, 1920, was declared, making the total dividends paid to date by the Reduction company, $450,000.

The Coniagas mine produced during the year from 97,634 tons of ore hoisted and concentrated 994,235 ounces of silver; the output the previous year was 940,267 ounces. An average price of $1.225 per ounce was received for the silver, as compared with $1.06 last year. The cost of mining and milling amounted to 49 cents per ounce, as compared with 35 cents last year; and the cost of smelting, refining and marketing was 7.35 cents per ounce, as compared with 7.45 cents last year. The average cost per ounce of silver produced during the last fourteen years, including all charges, has been 18.76 cents per ounce. Four dividends of $100,000 each, amounting to 10%, and also a bonus of $100,000.00 were paid on May 1, 1920; another dividend of 2 1/2% was declared payable on November 1, 1920. These disbursements make a total distribution to date of $10,140,000, of which $7,900,000 was paid as dividends and $2,240,000 as bonuses.

The average number of men employed at Cobalt by the company during the year was 105.04 on a seven-day basis, or 122.55 on a six-day basis.

The concentrating mill and flotation plant operated continuously except during three holidays. The mill ran 92.29% of the possible time, or 91.78% of the total time; the corresponding figures for the previous year were, 92.39% and 79.12%. The tonnage of ore milled was 97,634.3, or an average of 4.91 tons a stamp for 24 hours; 71,743.8 tons were milled the year before, or 4.14 tons per stamp. Mill heads for the year averaged 10.22 ounces per ton. High grade concentrates shipped amounted to 388.60 tons (dry weight) and contained 1,754.6 ounces of silver per ton.

The flotation plant treated all tailings from the concentrating mill and all re-ground sand from the tailings pile. An extraction of 62.75% was made, leaving a tailing of 1.43 ounces of silver to go to waste. Shipments of flotation concentrates amounted to 522.84 tons (dry weight) and averaged 486.25 ounces of silver per ton.

The retreatment of old sand tailings was carried on except during the winter months. The total tonnage reclaimed, 37,695, was re-ground and re-treated, and an average of 1.94 ounces of silver per ton was recovered. A total of 80,264.9 tons has been re-treated to date, and 96,735.1 tons, containing 314,389 ounces of silver, remain to be treated.

A system for re-claiming old slime tailings was put in use on June 15, 1920, and cyanidation of these tailings was carried on continuously until October 15, when the lack of air power necessitated closing down for the winter. A total of 6,440 tons of slime, averaging 6.1 ounces of silver per ton, was treated with an average extraction of 83.87%, and an average tailing of 1.0 ounces of silver. There remain to be treated 33,560 tons of these tailings, containing 208,072 ounces of silver. The cyanide mill at the Buffalo mine is being leased for the cyanide treatment.

There are stacked on the Trethewey property of this company 37,000 tons of sand tailings, containing 173,900 ounces of silver.

Development work was seriously affected during the latter half of the year by the scarcity of underground labour. Small blocks of ground along the north boundary were explored, and the extensions necessary to connect with the Trethewey workings were made. This work developed a considerable tonnage of low grade milling rock. The equipment of the third level as a main haulageway was completed, and an electric system of haulage is now in use.

The reserve of broken ore on stulls in the mine has been increased by 13,521 tons. There is enough ore broken in the mine to keep the mill operating at capacity for over one year.

Ore shipments for the year amounted to 20.4 tons; this consisted of 5.61 tons of high grade ore, averaging 3,309.5 ounces of silver per ton, and 14.8 tons of low grade, averaging 11.44% cobalt. The total shipments from the Coniagas to date amount to 18,279 tons of ore and concentrates containing 28,188,763 ounces of silver.

The work done during the year and also the total work done to date are tabulated below.

	Total to Oct. 31, 1920	Total to Oct. 31, 1919	Development 1919-1920
Shaft Sinking, feet	879	879	....
Drifting, feet	21,703	20,993	710
Crosscutting, feet	11,152	11,007	145
Winzing, feet	750	750	....
Raising, feet	1,905	1,790	115

	Tonnage Removed to Oct. 31, 1920	Tonnage Removed to Oct. 31, 1919	Tonnage Removed 1919-1920
Crosscutting	55,097.1	54,517.1	130.0 Waste 450.0 Ore
Drifting	71,021.5	67,941.5	3,080.0 Ore
Stoping	630,975.0	537,285.1	93,689.9 Ore
Open Cutting	4,880.0	4,880.0	
Winzing and Raising	9,048.9	8,654.9	394.0 Ore
Shaft Sinking	2,955.0	2,955.0	
	773,977.5	676,233.6	97,743.9

Ore Milled in Tons

Total to Oct, 31, 1920	Total to Oct. 31,1919	Milled During 1919-1920
693 440.1	595,805.8	97,634.3

Milling Ore and Rock Hoisted in Tons

	Total to Oct. 31, 1920	Total to Oct. 31, 1919	Hoisted During 1919-1920
Milling Ore	693,440.1	595,805.8	97,634.3
Rock	61,999.0	61,869.0	130.0

From the Trethewey mine, now owned by the Coniagas, 7,482 tons of ore were obtained, which yielded approximately 70,000 ounces of silver. There is still in this mine 5,000 tons of broken ore. The price paid for this property is assured, and it is anticipated that a fair profit will be made on this investment.

Conroy-McAndrew.—The Conroy-McAndrew Silver Mines worked claim 901 in the Gillies Limit south of Giroux lake from May to October 8, 1920.

A compressed air pipe-line was laid to the claim, an engine house and head frame built, and a 6-inch by 8-inch Jenckes hoisting engine set up. In June a two-compartment shaft was started; this was sunk 100 feet, and 170 feet of crosscutting done at the bottom.

J. A. McAndrew was superintendent and had from four to sixteen men employed.

Cross Lake.—Cross Lake Silver Mining Company, Limited, incorporated on June 28, 1907, with a capitalization of $1,000,000, worked its property at the south end of Cross lake during 1920. On March 24 the mine became flooded owing to a rising of the waters of Cross lake; this was caused by an accumulation of tailings in Mill creek. Up to this date 14 men had been employed, but from this time until December 19, when work was stopped entirely, 4 men were employed.

The development work done during the year was: in the Cross Lake mine on the 70-foot level, 325 feet of drifting, 86 feet of crosscutting and 67 feet of raising; in the Old Chap mine, 20 feet of drifting on the 130-foot level and 15 feet on the 200-foot level. The work at the Old Chap mine was done during the three or four weeks in which the Cross Lake mine was flooded.

The officers of the company are: Carl Reinhardt, Cobalt, president; George L. Cavanagh, Montreal, vice-president; R. F. Kellock, Cornwall, secretary-treasurer.

Crown Reserve.—The Crown Reserve Mining Company, Limited, has an authorized capital of 2,000,000 shares of $1.00 par value each. The officers are: John W. Carson, president and managing director; William I. Gear, 1st vice-president; James G. Ross, 2nd vice-president; James Cooper, secretary-treasurer; John Reid, assistant secretary-treasurer; H. J. Stewart, manager; H. R. Bischof, superintendent.

The Crown Reserve mine was worked with a force of 50 men until the month of May when, owing to the drop in the price of silver, the force was reduced to 35 men and the work restricted to the development and exploration of the lower levels of the mine; still later the force was cut to 15 men. The net value of the year's production was $34,260.00. The total footage driven underground amounted to 2,146.

On the advice of the consulting geologist a deep diamond drill hole was started from the 500-foot level and put down a distance of 1,500 feet. The reason for drilling this hole was to ascertain whether below the present workings there exists another diabase sill similar to the one found on the surface adjacent to and in close relationship with the ore deposits of the Cobalt area. No veins were intersected, nor were there any indications of another sill within this distance.

Some development work was done on the Drummond Fraction property.

The company stopped all work on January 30, 1921.

The Porcupine Crown gold mine, controlled by the Crown Reserve Mining Company, was purchased on May 15, 1920, by the Northcrown Porcupine Mines Limited, who also bought the Porcupine Thompson-Krist. The new company owns a total area of 160 acres and is doing considerable development work.

Dickson Creek.—The Dickson Creek (Cobalt) Silver Mines, Limited, continued to work on the northeast quarter of the north half of lot 9, concession V, Bucke township, until December 22, 1920. The incline shaft was continued from 150 feet to 250 feet, and crosscuts driven on the 250-foot level 15 feet north and 15 feet south.

Five men were employed under the supervision of H. Hollands-Hurst of Haileybury, Ont.

Dominion Reduction.—The Dominion Reduction Company, Limited, had an average of 63 men employed in its custom mill on the Nova Scotia claim at Cobalt. The officers are: D. M. Steindler, president; Leslie L. Steindler, secretary; G. W. Perram, manager.

A total of 42,181.59 tons of custom ore was milled from the following sources: Kerr Lake, 29,823.26 tons; Crown Reserve, 5,113.68 tons; Peterson Lake, 3,894.43 tons; Aladdin, 1,017.19 tons; Reliance, 811.27 tons; Right-of-Way, 690.59 tons; Edwards and Wright, 346.83 tons; Silver Queen, 255.52 tons; Colonial, 228.82 tons. In addition, there were milled 50 tons of ore from the Nova Scotia mine, and 4,000 tons of tailings from the bed of Peterson Lake were retreated.

On November 5 the re treatment plant was closed owing to a shortage of power. About the end of the year the mill was closed, as the shipments of ore stopped on account of the low price of silver.

Genesee.—The Genesee Mining Company, Limited, continued to prospect the southwest quarter of the south half of lot 9, concession 1, Bucke township for the first five months of 1920. The development work done during the year consisted of 196 feet of crosscuts on the 350-foot level, and 497 feet of drives and a 22 -foot winze on the 500-foot level.

L. F. Steenman, Cobalt, is manager.

Green-Meehan.—Edwards and Wright, Limited, of 120 Bay Street, Toronto, operated the Green-Meehan mine near North Cobalt with a force of about 20 men. H. G. Young was manager.

A 400-cubic-foot Alley and McLellan air compressor, driven by a 75-h.p. motor, was provided to replace the steam-driven compressor formerly in use.

Stoping was continued on the 200-foot level, and 1,559.56 tons of milling ore were shipped to the Cobalt Reduction mill and 346.83 tons to the Dominion Reduction mill. The development work consisted of 1,500 feet of driving and 500 feet of raising.

As the results obtained were not encouraging, the mine was closed down at the end of the year.

Hudson Bay.—In 1920 the Hudson Bay Mines, Limited, worked its No. 1 mine at Cobalt but did nothing at its Gowganda and Kirkland Lake mines.

For the fiscal year ending August 31, 1920, the development work done consisted of 262 feet of crosscutting, 107 feet of drifting, and 40 feet of raising. There were hoisted and milled 20,308 tons of 6-ounce ore; of this total, 316 tons were from development, 9,554 tons from stopes, 4,927 tons from open cuts, and 5,511 tons from surface dumps. The concentrates produced amounted to 344 tons containing 95,444 ounces of silver. The mining cost was $55,234 and the milling cost $39,837-44. An average price of $1.155 per ounce was received for silver. The profit for the year's operations was $3,086.62.

The mill was shut down on October 12 and the working force reduced from 40 to 13 men. As the ore reserves containing about 30,000 ounces were almost depleted, the men retained were put on development work. This work during the winter months produced fairly satisfactory results, but the continued decline in the price of silver caused all work to be suspended on April 11, 1921.

The officers of the company are: A. L. McKelvie, New Liskeard, president; William H. Kinch, Buffalo, N. Y., vice-president; F. L. Hutchinson, New Liskeard, secretary-treasurer; D. M. McPhail, Cobalt, manager.

Kerr Lake.—The Kerr Lake mines at Cobalt are owned and operated by Kerr Lake Mines, Limited. This company has now a capitalization of $2,400,000, which is divided into shares of $4.00 par value. The head office is at 61 Broadway, New York, and the board of directors consists of: Adolph Lewisohn, president; Sam A. Lewisohn, vice-president; E. H. Westlake, secretary-treasurer; Julius H. Susmann, J. Parke Channing, D. M. Steindler, J. J. Steindler, Wm. B. Joyce, Thos. L. Herrmann. H. A. Kee is manager, and an average of 90 men is employed.

The manager's report for the fiscal year ending August 31st, 1920, states:

The gross production for the fiscal year amounts to 956,050 ounces of silver, 42,654 pounds of cobalt, and 34 pounds of mercury. These figures include 88,598 ounces of silver on hand August 31, 1920, according to inventory. Of the total, 629,216 ounces of silver, 42,654 pounds of cobalt, and 34 pounds of mercury were produced from shipping ore and 326,834 ounces of silver from low grade ore milled by the Dominion Reduction Company at Cobalt.

The year's development work amounted to 2,969 feet making the total to date 59,891 feet. No new veins of much importance were encountered, but both high grade and milling ores were found in extensions of ore shoots in old stopes. During the year 17,960 tons of ore and 5,191 tons of waste were hoisted. The ore milled, includng that obtained from the dump, was 23,150 tons and contained 12.5 ounces of silver per ton, as compared with 17.3 ounces in 1919. The cost of production was 56.04 cents per ounce of silver. This sum was composed of: mining and development charges, 25.48 cents, shipment and treatment charges, 26.69 cents, and administration charges 3.87 cents.

The company has paid in dividends to date $8,310,000.00. On September 22, 1919, a capital distribution of $600,000 or $1,00 per share was made.

During the winter of 1920-21 work was restricted to the No. 3 mine and to the Hargrave mine adjoining, which was under option. Forty to fifty men were employed during this period. The Hargrave mine was bought in March for $16,250.

La Rose.—La Rose Mines, Limited, capital $1,500,000 in shares of $1.00 par value, operates several mines at Cobalt. The officers are: D. Lorne McGibbon, president; Shirley Ogilvie, vice-president; Stephen J. Le Huray, secretary-treasurer; G. C. Bateman, general manager. The head office is at 260 St. James Street, Montreal.

The general manager's report for 1920 gives the production for the year from the La Rose properties as 410,445 ounces of silver and 385 tons of cobalt, contained in the ore and for which payment was received. The total output was valued at $313,995.74, and operating costs amounted to $300,716.01; the net profit on production for the year was, therefore, $13,279.73. Owing to the greater output and to economies effected, the cost per ounce of silver was reduced from $1.05 in 1919 to 73 cents in 1920. The net current surplus was $490,936.00 at the end of the year.

The concentrator treated 33,035 tons of ore of an average grade of 14 ounces as compared with 11.1 ounces in 1919. The concentrates obtained totalled 1,013.6 tons and contained 392,052 ounces of silver, or an average of 387 ounces per ton.

The underground work done during 1920 in the La Rose, Princess, and Violet is tabulated below:

	Shafts ft.	Drifts ft.	Crosscuts ft.	Raises ft.	Stations cu. yds.	Stopes cu. yds.
La Rose		118.5		183.5		4635
Princess		551.5	195.5	47.	6	3702
Violet	72	526.	610.5	32.	77	1746
Total	72	1196.0	806.0	262.5	83	10083

Details regarding the several mines of the company are as follows:

La Rose.—The La Rose mine shipped to the concentrator 10,134 tons of ore, averaging 16.2 ounces per ton, and in addition 3,873 ounces were obtained from high grade and cobalt ores, making the total silver production 167,533 ounces. The ore came from pillars and old stopes, principally on the "Powder House" vein; most of this vein has been worked out, and 3,000 tons remained broken in the stopes at the end of the year.

Violet.—In October the shortage of power forced a cessation of work on the lower levels, and, in view of the uncertain outlook for power, it was decided to allow them to remain flooded until spring. Production for the year was 81,476 ounces of silver.

Princess.—The Princess was a steady shipper of milling ore, and a fair production for 1921 is assured. This mine shipped 15,650 tons of ore containing 14.3 ounces per ton, and high grade ore containing 8,276 ounces; the gross production was, therefore, 167,533 ounces.

University.—The University mine is operated by the University Mines, Limited, and La Rose Mines, Limited, owns 97.26% of the stock. Work at No. 3 shaft was continued and a total advance was made of 2,263 feet in drifts, crosscuts and raises. A new ore body was found about 20 feet above and a short distance south of the 90-foot level; a stope, 170 feet long, was opened up on this ore body, which consists of milling ore with stringers of high grade and at the west end of the stope is consolidated into a three-inch vein of high grade ore. The total net production for the year was 100,895 ounces of silver. This was obtained from 6,086 tons of milling ore, averaging 19.3 ounces per ton and from which the concentrator recovered 49,294 ounces and 20.6 tons of high grade averaging 2,500 ounces per ton.

Early in 1921 a promising parallel ore body, carrying about three inches of high grade ore, was encountered a short distance to the north in an area of Huronian slates.

The average number of men employed was 105.

Lumsden.—The Lumsden mine was worked under lease until December 14, 1920, by Campbell and Fairburn (Camburn Silver Mines, Limited). Major J. H. Rattray was manager and had 12 men employed.

The work performed during the year consisted of: 1000 feet of drifting and crosscutting on the 300-foot level, the sinking of a 30-foot winze, and 9,314 cubic feet of stoping. A body of medium grade ore was opened up.

McKinley-Darragh-Savage.—The McKinley-Darragh-Savage Mines of Cobalt, Limited, capital, $2,500,000 in shares of $1.00 par value, operates the McKinley-Darragh-Savage mines. The Company's offices are at the Trusts and Guarantee Building, Toronto and Cobalt, Ont. The officers of the Company are: J. R. L. Starr, president; Thos. W. Finucane, vice-president; Harper Sibley, treasurer; J. H. Spence, secretary; T. R. Finucane, general manager; H. C. McCloskey, resident manager.

The mines and mill, employing 155 men, were in operation during 1920, and the tailings mill ran from May until the power shortage in November.

The ore removed from mines and dumps was 63,528 tons all of which was milled, and, in addition, 30,205 tons of sand tailings were retreated. The silver recovered during the year was 627,360 ounces and a total of 613,483 ounces was shipped.

The silver recovered was distributed in the following classes of products:—

Classification	Tons of Product	Ounces of Silver	Percentage of Total	Average Ozs Per Ton
Nuggets	.256	5,110	0.8	19,960.9
Below 550 ounces per ton	66.765	26,055	4.2	390.2
550 to 1000 ounces per ton	85.382	63,012	10.0	738.0
1000 to 2000 ounces per ton	38.131	47.143	7.5	1,236.3
Over 2000 ounces per ton	9.347	36,172	5.8	3,869.9
Sand Concentrates	337.921	234,762	37.4	694.7
Flotation Concentrates	608.330	215,106	34.3	353.6
Totals	1,146.132	627,360	100.0	547.4

The total production of silver to date has been 19,622,403 ounces. The year's underground work consisted of: 1110 feet of crosscutting, 1084 feet of drifting, 535 feet of raising and the breaking of 38,990 tons in the stopes.

The ore broken in the mine amounts to 25,000 tons and there was also developed during the year a considerable tonnage that has not yet been broken; but the greater portion of this ore on hand cannot be profitably treated at present prices of silver.

The fall in the price of silver during 1920 from $1.31 an ounce at the beginning of the year to 64¼ cents at the close caused operations to become unprofitable as the average cost of producing silver was 85½ cents an ounce. This resulted in an operating loss of $17,468.57, and a total net loss of $40,574.24 for the year.

The mine was shut down at the close of the year.

Three dividends of 3%, amounting to $202,292.28 were paid during 1920 and the surplus now stands at $122,735.41.

Mining Corporation.—The Mining Corporation of Canada, Limited, has an issued capital of $8,300,250 in charges of $5.00 par value. The officers of the company are: president, J. P. Watson; 1st vice-president, W. R. P. Parker; 2nd vice-president, G. M. Clark; directors, E. H. Rose, J. G. Watson, Thomas Plunket, Capt. C. E. Trafford; consulting engineer, Scott Turner; resident manager, M. F. Fairlie, secretary, W. W. Perry. The head office is at 1512-1520 Bank of Hamilton Building, Toronto.

The silver production from the company's Cobalt properties for the year 1920 was 1,664,018 ounces, an increase of 433,365 ounces over the 1919 production. The net profits were $579,569.96, and the surplus stands at $3,268,628.53.

The average number of men employed was 227, of whom 122 were engaged in mining and 93 in the mill.

The ore reserves on the old properties are estimated to contain 830,940 ounces of silver, and those in the Buffalo mine are estimated at 1,350,060 ounces making a total of 2,181,000 ounces.

An active search for new properties was continued during the year, about 300 properties being examined. An interest was taken in an option on the Flin Flon gold-silver-copper property in Manitoba. This option lapsed on March 31st, 1921 and early in May the company acquired by purchase a majority interest in this property on which in the past few years over half a million dollars has been expended in exploration work and diamond drilling.

The resident manager's report for 1920 summarizes the operations in great detail:

Satisfactory underground developments permitted a large increase in tonnage milled and in silver production during the year. The production figure of 1,664,018 ounces as compared with 1,230,653 ounces for the previous year, shows an increase of 433,365 ounces.

In spite, however, of this improvement, the unexpected drop in the market price of silver has resulted in reduced net profit for the year's operations.

A pronounced shortage of labour hampered efficient operation during the greater part of the year, in spite of the fact that wages in both underground and mill work showed the highest average in the history of Cobalt.

Shortage of power in the latter part of the year compelled suspension of tailing treatment operations and proportionately reduced production from that source.

The amounts of ore broken and ore hoisted from the time were 38,258 tons and 51,171 tons respectively.

Silver Production

Owing to various changes in milling practice by the Cobalt Reduction Co., Ltd., and to the fact that the Reduction Company was treating a considerable tonnage of purchased ore in its low grade mills, it became difficult to segregate and return to the Corporation the various products from ore treated. A wide difference in both the character and assay value of the ore from different mines added to the difficulty.

For the above reasons, and also as no adjustment of treatment charges had been made with the Reduction Company to cover its increased costs since 1915, a new agreement, dating from Oct. 1st, 1920, was made, under which the Reduction Company purchases the ore of the Corporation. In payment, the Reduction Company returns to the Corporation, in the form of refined silver bullion, a percentage of the silver contents of the ore treated. This percentage varies with the average assay value of the ore delivered each month and ranges from 80% for ore assaying up to 15 ounces per ton to 91% for ore assaying over 41 ounces per ton. The Reduction Company charges the Corporation $8.00 per ton for treatment, including high grade treatment.

Ore Reserves

Townsite, City and Lake Mines.—The ore reserve estimate shown below covers the Townsite, City and Lake properties of the Corporation.

	Tons Ore		Ounces Silver	
	1920	1919	1920	1919
Total	28,950	38,735	830,940	1,307,220

The total is made up of 16,981 tons, carrying 453,325 ounces, in place, and 11,969 tons, carrying 377,615 ounces, of broken ore in stopes.

A decline on both tonnage and ounces in reserve will be noted. During 1920, 51,918 tons containing 1,591,890 ounces, were mined from the above mentioned properties, figures greatly in excess of the total reserves shown at the end of 1919.

Buffalo Mine.—The reserves, in the Buffalo, stand at the end of the year as follows:

Tons Ore	Ounces Silver
74,653	1,350,060

The total is made up of 41,336 tons, carrying 826,720 ounces, in place, and 33,317 tons, carrying 523,340 ounces, of broken ore in stopes.

TOTAL ORE RESERVES

	Tons Ore		Ounces Silver	
	1920	1919	1920	1919
Broken	45,286	23,019	900,955	866,945
In Place	58,317	15,716	1,280,045	440,275
Total	103,603	38,735	2,181,000	1,307,220

Townsite, City and Lake Mine.—Diamond drilling operations begun towards the end of the year gave results indicating the possiblity of developing new ore. Exploration has not yet reached the point where the importance of this work may be estimated.

TAILING

There remain in the bed of Cobalt lake approximately 275,000 tons of tailing available for reclaiming. The value of this material under present market conditions is problematical. Lower costs and higher price of silver must obtain before profitable treatment of this tailing can be resumed.

NEW PROPERTIES

Foster.—The tonnage of this mine amounted to 9,284 tons which, after milling, gave a production of 127,355 ounces in 1910. This is not included in production figures of the Mining Corporation.

The property was temporarily closed in November to relieve the power shortage situation, and work will be resumed when power is again available.

Buffalo.—This property owned by the General Examining & Developing Co., Limited,[1] was actively developed during the year with very satisfactory results. Practically no ore was treated in 1920, operations being confined to breaking and storing for reserve.

THE COBALT REDUCTION COMPANY, LIMITED

Concentrating Plant.—Except for four days lost owing to legal holidays, this plant ran continuously throughout the year. Sixty stamps ran 494,004 out of a possible 521,076 stamp hours or 94.8% of the possible running time.

The tonnage of mine ore treated in the low grade plant was 63,416 tons against 38,467 tons in 1919. This tonnage was shipped by the folowing mines:—

Mining Corporation	51,918.19
Central Operating Co., Limited (Foster Lease)	9,280.16
General Examining & Developing Co. Limited (Buffalo Mine)	475.00
Sundry	1,742.71
	63,416.06

Comparative details of concentration treatment for 1920 and 1919 follow:

	1920	1919
Tons treated	63,416.06	38,466.52
Average assay	28.80	32.68
Ounces contained	1,826,648.04	1,256,960.26
Tons concentrate produced	910.78	457.99
Average assay	1,522.66	2,049.17
Ounces contained	1,386,809.45	938,500.83
Percentage of Extraction by concentration	75.92	74.66

Cyanide Plant.—This plant ran 344 days in 1920 treating the slimes produced in crushing mine ore, and middlings from the Buffalo flotation plant.

From November 23rd to December 11th the plant was closed, all slimes being treated by flotation. However, owing to high mill heads at this time, it was necessary to re-open the cyanide plant. From September 16th to November 23rd, only middlings produced at the Buffalo mill were cyanided.

1. All the shares of this Company are owned by the Mining Corporation of Canada, Limited.

The tonnage treated was 36,663 against 35,029 tons in 1919. The baser character of the ore and the inclusion of flotation middlings resulted in a lower extraction by cyaniding.

Details of treatment follow:

	1920	1919
Tons cyanided	36,662.53	35,029.14
Average assay	10.62	9.13
Ounces contained	389,444.23	319,805.85
Ounces recovered	306,531.34	258,362.07
Percentage of extraction	78.71	80.79

Flotation Plant.—Early in the year the Buffalo flotation plant of the General Examining and Developing Co., Limited, was leased. During the winter an aerial tramway was installed to transport the tailing from the bed of Cobalt lake to this plant for treatment. Pipe lines were installed between the cyanide and Buffalo plants for the transfer of slime and middlings.

Details of tonnage, etc., are given below:

Tons of Cobalt Lake tailing treated	71,476.00
Average assay	3.92
Ounces contained	279,932.76
Tons of mine ore slime treated	12,000.72
Average assay	8.47
Ounces contained	101,663.41
Total tons treated	83,476.72
Average assay	4.57
Total ounces contained	381,596.17
Tons flotation concentrate produced	245.83
Average assay	792.59
Ounces contained	194,842.11
Percentage of extraction by flotation	51.06
Tons of middlings to cyanide plant	6,379.10
Average assay	15.47
Ounces contained	98,661.60

Summary of Milling Operations

		Extraction per cent.
Tons of mine ore milled	63,416.06	
Tons of Cobalt Lake tailing milled	71,476.	
Total tons	134,892.06	
Average assay	15.62	
Ounces contained	2,106,580.80	
Table concentrate produced, ounces	1,386,809.45	65.83
Flotation concentrate produced, ounces	194,842.11	9.25
Bullion produced from cyaniding, ounces	306,531.34	14.55
Total ounces produced	1,888,182.90	89.63

High Grade Plant.—This plant treated all the table concentrate produced in the low grade mill and all the flotation produced in the Buffalo mill with the exception of 46 tons which will be shipped to the smelter. In addition 406,85 tons of purchased high grade ore and concentrate were treated. The total was 1,507.17 tons against 1,059.04 tons in 1919. The refinery produced 2,113,326.08 ounces of refined bullion of which 1,806,794.74 ounces were from the high grade plant and 306,531,34 from the low grade cyanide plant.

Residues from the High Grade Plant were shipped to the smelter, payment being made for the silver and cobalt contents. Shipments in 1920 amounted to 1,530.71 tons.

Nipissing.—Nipissing Mines Company, Limited, has an authorized and issued capital of $6,000,000 divided into shares of $5.00 par value. The officers of the company are: E. P. Earle, president; Alexander Fasken, secretary; P. C. Pfeiffer, treasurer; The directors are: W. H. Brouse, John H. Black, and David Fasken of Toronto; Richard T. Greene, E. P. Earle, August Heckscher, and R. B. Watson of New York. The head office is in the Excelsior Life Building, Toronto, and the New York office at 165 Broadway.

The operating company is the Nipissing Mining Company, Limited; the authorized and issued capital stock consists of 2,500 shares of $100.00 par value and is all owned by Nipissing Mines Company, Limited. The officers are: David Fasken, president; E. P. Earle, vice-president; Alexander Fasken, secretary; P. C. Pfeiffer, treasurer. The directors are: John H. Black and David Fasken of Toronto; E. P. Earle, Richard T. Greene and R. B. Watson of New York. The operating officers are: R. B. Watson, general manager; Hugh Park, manager; James J. Denny, mill manager. The head and mine offices are at Cobalt, Ont.

During the year ending December 31, 1920, 83,348 tons of ore was produced; this consisted of 1,024 tons of high grade ore and 82,324 tons of low grade.

In the high grade mill the materials treated were: 1,017 tons Nipissing ore, assaying 1,146 ounces silver; 857 tons Nipissing concentrates, assaying 1,240 ounces silver; 229 tons of custom ore, assaying 2,172 ounces silver; 64 tons by-products, assaying 1,674 ounces silver. No change was made in the methods of treating high grade ore.

In the low grade mill 81,700 tons of ore averaging 27.38 ounces silver were treated; the average tailing was 2.60 ounces—a recovery of 90.55%. A new regrinding plant, consisting of a 4-foot by 24-foot tube mill in closed circuit with two duplex Dorr classifiers with 15-foot bowls, has been added to take the overflow from the classifiers of the main crushing plant. This product contains 30% to 40% of sand, 10% being plus 200 mesh. By regrinding with one-inch iron balls the percentage of sand is reduced by one half, and the final product going to the cyanide tanks carries only 1% to 2% plus 200 mesh; this regrinding effects an additional saving of about one ounce of silver per ton. With this safeguard in operation, the picking plant was shut down on December 1, and the high grade ore is now sent with the low grade to the stamps; the roughing tables following the stamps are relied upon to collect the high grade cobalt mineral. Since these changes were made, the recovery has been increased to over 95%. The treatment costs of the low grade ore, including transportation and picking plant expenses, averaged $4.94 per ton.

The Nipissing mines produced 3,332,303 ounces of silver in 1920; this had a gross value of $2,503,223.72 and a net value of $2,418,645.17. The total cost of producing this silver was $1,246,404.82—an average cost of $15.068 per ton of ore, or 37.4 cents per ounce of silver. The shipments from these mines since their discovery in 1903 have contained a total of 58,835,571 ounces of silver; this silver, and the cobalt, nickel and arsenic paid for have paid for have had a gross value of $39,951,344.46 and a net value of $38,349,499.07. Shareholders have received in dividends, $22,740,000.00.

The undergound work done in 1920 consisted of:

Development

The total amount of underground advance was about the same as in recent years. Work was carried on in 104 faces, exclusive of stopes.

Exploration into new territory and the closer examination of areas in the immediate vicinity of known veins amounted to 56% of the total advance.

No large veins of importance were found. A number were sufficiently encouraging to require development and in a few instances this work produced small amounts of ore, mostly mill rock.

Drifting and raising on new small veins amounted to 44% of the total advance, most of th work being unproductive. Stoping operations were carried on in 22 stopes.

There were no new developments of much importance on the older veins. They continued to be the main sources of production, and in every case exceeded expectations.

General underground development has reached the point where it is now possible to maintain only one central hoisting shaft on each side of the lake, all haulage from surrounding workings being done by electric locomotives.

Shaft 63.—Operations were considerably increased during the year, the advance at this shaft amounting to 44% of the total.

A haulage crosscut to tunnel 96 was completed, which has simplified all operations in the township area now being worked.

Exploration resulted in finding several new veins, mostly small and low grade, but at least three or four will be productive.

The veins to be worked through shaft 63 have a combined reserve of over a million ounces.

Shaft 64.—The only work done at this shaft consisted in the completion of a long crosscut to the northern limit of the property. Nothing of interest was found.

New development from shaft 73 has connected the lower levels of vein 64 with the direct haulage system to the main shaft.

Shaft 73.—Nearly one half of the total advance was done through this shaft. Stoping operations also provided most of the underground tonnage sent to the mill.

Considerable exploration work found only a few veins of little importance.

Vein 490 continued to be the largest individual producer; it also has the most in reserve.

Considerable work was done on vein 544, but it will not produce much ore. Ore occurrences in this vein have always been erratic. Two branch veins produced small amounts of good ore.

Shafts 80 and 128 were not worked during the year.

A summary of underground work done in 1920 follows:

Shaft No.	Drifting feet	Crosscutting feet	Raising feet	Total feet	Stoping cubic yards
63	1784	1513	291	3588	900
64	12	623	15	650	
73	1058	2525	393	3976	11,576
Totals.....	2854	4661	699	8214	12,476

The ore reserves are estimated to be as follows:

	Tons	Assay	Total silver content in ounces
High grade ore.....	1,851	1,183	2,188,903
Low grade ore.....	70.814	19.5	1,379,224
Totals	72,665	49.1	3,568,127

In the annual report of the company for 1920 the general manager says:

The average grade of the total ore going to the mills was 41.6 ounces per ton compared with 49.9 ounces in 1919.

It must be realized by stockholders that the Nipissing property has been under development for sixteen years and that, therefore, important veins are not as likely to be found in the future as they have in the past.

The usual scouting for new properties was carried on in Canada and elsewhere. A majority interest in a promising iron property near Brewster, N. Y., was acquired at a very satisfactory price. After putting down two dry holes on the oil lease at Henrietta, Texas, work was discontinued, but it is possible that further drilling will be done by outside parties for an interest in the lease.

During the year two dividends of five per cent each and two dividends of ten per cent each were paid, making a total disbursement to shareholders of $1,800,000.00.

The average number of men employed was 275.

Northern Customs and Bailey.—Northern Customs Concentrators, Limited, operated its mill at mileage 104 on the T. and N. O. Railway during the first quarter of the year. On April 1, after buying the Bailey silver mine at Cobalt, the company was liquidated and the operations continued under the name of the Bailey Silver Mines, Limited, the directorate of which is the same as that of the liquidated company.

From January 1 to March 31 a force of 43 men was employed in the mill and 14,620.6 tons of ore were treated. This ore came from the following sources: La Rose mines, 9,366.3 tons; Silver Cliff mine, 3,562.8 tons; and Chambers-Ferland mine, 1,691.5 tons.

From April 1 to the end of the year an average of 44 men was employed in the mill and 45,792 tons of ore were treated. This ore came from the following mines: La Rose, 29,880 tons; Silver Cliff, 11,343.8 tons; Chambers-Ferland, 1,515.7 tons; Right of Way, 1,999.5 tons; Bailey, 1,053 tons.

The officers of the company are: A. J. Young, president, Toronto; C. J. Booth, vice-president, Ottawa; F. J. Bourne, general manager, Cobalt; C. J. B. Armstrong, superintendent, Cobalt.

The mining work done by both companies is summarized below:

Bailey.—The Bailey mine was reopened on May 10 with superintendent A. S. Holmes in charge. A crosscut was driven south from the shaft on the fifth level for a distance of 300 feet. This encountered two veins in the first of which 50 feet of drifting and 20 feet of raising were done. From old pillars and stopes 1,053 tons of ore were obtained. Twelve men were employed.

Chambers-Ferland.—During the first half of the year a shaft pillar in the No. 1 Chambers-Ferland mine was stoped. From June to September some development work was done, access being obtained through the Right of Way shaft; this work consisted of 30 feet of raising and about 200 feet of crosscutting on the 90-foot level. Sixteen men were employed and 3,429 tons of milling ore was shipped. The mine was closed in September.

Silver Cliff.—The companies continued to work the Silver Cliff mine under lease until Nov. 11 when it was shut down. Milling ore, amounting to 14,906.6 tons was produced, and 22 men were employed.

Nova Scotia.—From June, 1920, to May 1, 1921, the Dominion Reduction Company had from four to eight men employed in stoping cobalt ore on the 50-foot level in the Nova Scotia mine.

O'Brien.—The O'Brien mine at Cobalt is owned and operated by M. J. O'Brien, Limited, of which M. J. O'Brien, Renfrew, is president; J. A. O'Brien, Ottawa, vice-president, and J. G. Dickenson, Cobalt, mine manager.

The production for the year has equalled that of former years and considerable ore has been developed to replace that taken out during the year. An average of 165 men was employed.

The progress underground for the year and the totals to date are tabulated below:

	1920	Total to date
Drifting	1,318 feet	54,319 feet
Crosscutting	934 feet	
Raising	42 feet	4,427 feet
Sinking	68 feet	
Stoping	45,065 tons	415,469 tons

Oxford.—Oxford Cobalt Silver Mines, Limited, was incorporated on March 27, 1919, with an authorized capital of $1,000,000 in shares of $1.00. The company owns claims A-100 and C-1,000 in the Gillies timber limit about half a mile south of Giroux lake. The officers are: A. H. Wilson, president; J. R. Shaw, vice-president; E. A. Ray, treasurer; G. W. Mahon, secretary; J. W. Russell, general manager. The head office is at Woodstock, Ont.

Work was started in March and a shaft was sunk on claim C-1,000 to the depth of 163 feet, Henry Sankey doing the work under contract. A level was opened at 150 feet, a crosscut driven north for 44 feet, and 138 feet of drifting done on the vein. Fifteen men were employed from April to October inclusive.

Peterson Lake.—The Peterson Lake Silver Cobalt Mining Company, Limited, continued to work its mine until the last week of 1920, when it was decided to shut down owing to the drop in the price of silver.

The development work done during the year included 137 feet of crosscuts and 483 feet of drifts.

The shipments of ore and concentrates for the year were as follows: 23,023 tons of flotation concentrates, containing 6,575.8 ounces of silver and obtained from 1,427 tons of dump ore milled at Peterson lake; 5,621 tons of high grade ore, containing 13,987 ounces; 39,946 tons of tailings concentrates, containing 5,435 ounces and obtained from the treatment in the Peterson Lake Dominion mill of 2,688 tons of lake tailings containing 11,450 ounces. 3,895 tons of milling ore, containing 69,661 ounces and shipped to the Dominion Reduction Company's mill; the total shipments, therefore, amounted to 3,963.7 tons, having a gross silver content of 95,658 ounces without any deductions by mills or smelters. The shipments included 791 pounds of cobalt containing high grade ore, averaging 7% cobalt.

C. A. Filteau is manager and an average of 20 men was employed.

Reliance.—The Reliance claim in Coleman township was worked under lease by Shaw and Dean during the first seven months of the year. A small amount of development work was done, and 811.27 tons were shipped to the Dominion Reduction Company's mill. From four to six men were employed.

Right of Way.—The Right of Way Mines, Limited, resumed work at its No. 4 shaft in February. Fifty feet of drifting were done and the first shipments were made in April. A total of 690.59 tons was shipped to the Dominion Reduction mill and 1,999.5 tons to the Northern Customs. An average of 20 men was employed up to July 14, when the company stopped work.

The officers are: C. Jackson Booth, president; E. A. Larmonth, vice-president; James Cunningham, secretary; D. H. Angus, manager. The head office address is Central Chambers, 46 Elgin Street, Ottawa.

Ruby.—On August 1, 1920, a Cobalt syndicate began to exploit the Ruby Silver claim, which consists of 40 acres in Bucke township, west of and adjoining the Red Rock claim; shortly after, the Ruby Operative Mines, Limited, was formed and continued work until the end of Februaury, 1921. The officers of the company are: C. H. Moore, president; Lieut.-Col. E. F. Armstrong, vice-president; Dr. E. W. Mitchell, Kenneth McDonald, and Bernard W. Hartley, directors; P. J. Hart, secretary-treasurer.

The company did the following work underground: drifted 30 feet; sank an inclined winze, about 48 feet deep, from the 70-foot level on the vein; and mined and shipped 187 tons of ore to the Cobalt Reduction Company's mill.

Silver Queen.—The Silver Queen mine was operated under lease by W. J. Post, who employed from two to six men. Shipments consisted of 9 tons of medium grade ore, worth about $2,000 and 255 tons of milling ore containing about 8½ ounces; the latter material was shipped to the Dominion Reduction Company. About 100 feet of crosscutting and 50 feet of raising were done, most of which was on the first level.

Temiskaming.—The Temiskaming Mining Company, Limited, has an authorized and issued capital of $2,500,000.00 in shares in $1.00 par value. The directors are: president, J. P. Bickell, Toronto; vice-president, J. B. Tudhope, M. P., Orillia; W. J. Sheppard, Waubashene, Ont.; W. Linton, Toronto; N. S. Dunlop, Montreal; Joseph Errington, San Francisco; Strachan Johnston, K. C., Toronto. M. P. Van der Voort, Toronto, is secretary and H. G. Lauz, Toronto, is treasurer. The head office is in the Standard Bank Building, Toronto.

The end of the Company's financial year has been changed from December 31 to June 30 to conform to the fiscal period of the Blue Diamond Coal Company, Limited, a half of whose capital stock had been bought by this company. Consequently the report from which the following notes are abstracted covers the eighteen months ending June 30, 1921.

Owing to the drop in the price of silver in 1920, it was first decided to curtail development work and finally to stop it, the supply of ore for the mill during October and November coming entirely from the broken ore reserves. In November, the shortage of power introduced another adverse factor, and it was decided to close down the mine entirely.

With a view to increasing the extraction and also treating the accumulated tailings, material was bought for an oil flotation plant consisting of two units, and one unit with a capacity of 125 tons per day had been about completed when the mine was closed.

The development work done during the year consisted of: drifting, 73 feet; crosscutting, 377 feet; raising, 366 feet.

The mill treated 34,911 tons of ore from which were obtained products having the following silver content:— jig concentrates, 63,797.5 ounces; sand concentrates, 161,148.0 ounces; slime concentrates, 17,406.4 ounces; high grade ore, 677.3 ounces; or a total of 243,029.2 ounces.

The profit and loss statement for the eighteen months is as follows:

Production:		
Ore sales	$271,330.05	
Less ore on hand Dec. 31, 1919	92,035.38	
		$179,294.67
Costs:		
Development and exploration	$31,828.80	
Mining	162,137.77	
Milling	84,166.42	
Shipping and marketing	8,380.94	
	286,513.93	
Administrative and General:		
General expense, mine office	$44,442.98	
Taxes, insurance, and general expense	35,582.56	
	80,025.54	$366,539.47
		$187.244.80
Miscellaneous Earnings:		
Interest, discount and exchange	49,049.76	
Miscellaneous	2,429.54	51 479.30
Deficit transferred to surplus		$135 765.50

The company's surplus is now $728,253.20.

Waldman.—The lease of the Waldman mines was transferred from Mosher and McKay to the Camburn Silver Mines, Limited, (incorporated on July 7, 1919, with a capital of $1,500,000) and the work was continued during the first half of the year with a force of five men. The work consisted of 58 feet of drifting, 21 feet of raising, and 330 feet of stoping. Major J. H. Rattray was in charge.

Elk Lake, Gowganda and Maple Mountain

Bonsall.—The Bonsall group of claims at Gowganda belongs to The Bonsall Mines, Limited, incorporated on September 25, 1909, with $3,000,000 capital stock. The president of the company is Clifford Sifton and the secretary is Harry Sifton, 18 Wellington Street East, Toronto. Little, if any, work has been done on these claims since 1910, with the exception of a small amount by M. J. O'Brien, Limited, in 1919.

In 1920, George Glendinning of the Standard Bank Building, Toronto, had 15 men employed from March to July doing trenching, sampling, and some further exploratory work underground. All of the exploratory work was done on claim R.S.C. 83 from the shaft which is on the line dividing this claim from claim R. S.C. 82 to the west. On the 70-foot level Mr. Glendinning did 100 feet of drifting and 70 feet of raising, on the 125-foot level, 180 feet of drifting. He also pumped out and sampled Nos. 2 and 3 shafts, which are on claim R.S.C. 84.

Cane.—Cane Silver Mines, Limited, was incorporated on October 12, 1917, with an authorized capital of $1,500,000 in shares of $1.00 par value; about 1,000,000 shares have been issued. The officers are: J. C. Houston, president; J. Walter Young, secretary; J. J. Bourne, manager. The head office is Haileybury, Ont. The property of the company is in lot 2, concession II, Cane township.

Work was carried on from August 9 to December 10. Comfortable camps, providing accommodation for 40 men, were built in the last month and a half. The buildings consist of: a three-story bunkhouse, 28 feet by 30 feet, a cookhouse and storehouse, 24 feet by 40 feet, a two-story office building, 24 feet by 28 feet, an ice house, 12 feet by 16 feet, a magazine, 10 feet by 14 feet, and a barn, 16 feet by 30 feet. Two miles of new road were built on high ground to connect with the wagon road from Kenabeek station, thereby shortening the route to the property by a mile and a half.

For the first two months open-cut work was done on veins 1,2, and 8.

It was then decided to confine efforts to sinking on vein No. 8; a shaft, 6 feet by 10½ feet, on this vein had reached a depth of 40 feet when the shut-down occurred. Up to October, 1, 100 sacks of ore, weighing 3½ tons and assaying 402 ounces of silver per ton, were shipped from the open cuts to the Cobalt Reduction Company, and at the time of closing 75 sacks more were ready for shipment.

Castle.—The Trethewey Silver-Cobalt Mine, Limited, owns and operates the Castle mine at Gowganda, comprising a group of mining claims between Miller and Everett lakes in the townships of Nicol and Haultain. J. P. Bickell is president of the company, and Murray Kennedy is manager. An average of 40 men is employed.

Development work for the year has been fairly successful. A total of 1,020 feet of drifts and crosscuts were driven. The incline shaft was continued from the 100 to the 150-foot level, and a 40-foot stope opened to the south of the shaft between these levels. On the 100-foot 790 feet of drifting and crosscutting were done, and on the lower level, 70 feet.

A new vein, which has been named the "Office" vein, was discovered during the year; this runs nearly at right angles to the vein first discovered. A vertical shaft was sunk on this vein to a depth of 82 feet and 160 feet of lateral work done on the 70-foot level. Five shipments, amounting to 46 tons and containing 63,000 ounces, were made during the year.

Collins.—F. Howard Collins resumed work on his claim T.C. 220 (2947) on the west side of Leroy lake in June, 1920, with a force of 14 men. Crosscuts were driven 38½ feet west and 27 feet east on the 200-foot level. After two weeks' operation, the air compressor, which was procured for this work broke down and work was suspended for two months. In September another start was made and the shaft sunk to a depth of 300 feet. Work was discontinued on December 8.

Miller Lake O'Brien.—This mine at Gowganda is owned and operated by M. J. O'Brien, Limited. J. G. Dickenson, Cobalt, is manager and H. G. Kennedy, Gowganda, resident superintendent.

During 1920 the underground work done consisted of: drifting and crosscutting, 1,581 feet; raising, 110 feet; ore broken, 26,302 tons, of which 18,633 tons were broken in stopes. Owing to a shortage of power in the latter part of the year, the mill was closed for three months. The employees numbered 82.

Miller Lake Silver Star.—The Miller Lake Silver Star Mines, Limited, carried on work on the Hart claim near Miller lake from January 24 to October 15, 1920.

After camps had been built and machinery set up, underground work was started on August 1 and continued until the shut-down in October; a few hundred feet of driving were done on the 100-foot level. The machinery consists of: an 80-h.p. locomotive-type boiler, a 25-h.p. vertical boiler, a 500-c.f. Ingersoll air compressor, and a 6-inch by 8-inch Rand hoist.

The head office of the company is at 99 St. James Street, Montreal, at the office of Robert T. Mullin, the vice-president. J. A. Montague was manager until October, when J. J. Trickey of Montreal took charge. There were 15 men employed.

Northcliff.—Northcliff Mines, Limited, continued the adit on its property to a distance of 230 feet. A force of eight men was employed until August 1, when the work was stopped. Norman E. Dye was manager.

Regent.—The Regent Mines, Limited, (authorized capital, $1,000,000 in shares of $1.00 par value), owns 80 acres in lot 1, concessions III and IV of the township of James. The officers are: William Dougherty, Sarnia, president; Dr. Pinard, London, Ont., vice-president; John Hale, Sarnia Paper Box Co., Sarnia, Ont., secretary-treasurer.

The company began work on July 1. Camps and a small power-house were built; and two vertical boilers of about 18 and 20 horsepower, and a 5-inch by 7-inch Napanee hoist were provided. An incline shaft was started in September and was 30 feet deep when work was stopped on December 19.

Reeve-Dobie.—Reeve-Dobie Mines, Limited, did some 200 feet of crosscutting on the 200-foot level and shut down the mine on September 8, 1920. From 15 to 20 men were employed under managing director M. H. Jacobs.

Rominco.—Rominco Mines Company, Limited, had seven men doing surface work on the Big Four property at Gowganda until the buildings were destroyed by fire on July 6. Three men were engaged in building a camp during August.

The company is capitalized at $1,500,000 in shares of $1.00 par value. The officers are: Dr. Carl A. Huber, New York, president; L. A. Chittenden, Messina, N. Y., vice-president; James J. Withal, 123 Central Building, Rochester, N. Y., secretary-treasurer.

Silver Bullion.—The Silver Bullion Mines, Limited, carried on work at its property at Leroy lake during a portion of the year. After setting up a mining plant, consisting of a 100-h.p. locomotive-type boiler, a six-drill cross-compound Ingersoll-Rand air compressor, and a 6-inch by 8-inch Jenckes hoisting engine, an incline shaft was sunk to a depth of 52 feet on the Dodds vein and 50 feet of drifting were done on the 75-foot level of the Island shaft.

The directors of the company are: Senator W. H. Sharp, Manitou, Man., president; Senator E. L. Girroir, Ottawa, secretary-treasurer; H. A. Frank, Millerton, N. B., managing director; J. Robinson; and John Walsh.

Triangle.—Triangle Silver Mines, Limited, continued to work its property in Auld township until the end of November, 1920. Driving was done on the 130-foot and 182-foot levels, and the incline shaft between these two levels was straightened. W. H. Jeffery, the manager, had 15 to 20 men employed.

Walsh.—Walsh Mines, Limited, incorporated on November 4, 1912, with a capital of $100,000 owns mining claims M.R. 1250, 1251, and 1252, and G.G. 3879. The company carried on work from March 25 to July 14 from a shaft 185 feet deep, on the south shore of Miller lake, and did 550 feet of drifting on the 185-foot level, making the total lateral work done on that level to date about 850 feet. Twenty men were employed.

The machinery comprises a three-drill compressor and an 8-inch by 10-inch Lidgerwood hoist.

The board of directors for this company is the same as that for the Silver Bullion Mines, Limited. Albert Terrill was manager.

White Reserve.—The White Reserve Mining Company, Limited, had twelve men employed during the summer at its mine in Whitson township, near Maple mountain. Work was stopped on September 13, when an option was given to English capitalists represented by J. B. Tyrrell. Mr. Tyrrell intends to do some diamond drilling.

The shafts at this mine were enumerated in the Twenty-Seventh Annual Report of the Bureau of Mines.

J. A. McAndrew, 408 Lumsden Building, Toronto, is president and general manager of the company.

IV. Southern and Eastern Ontario

Celestite

Wilder.—A celestite mine was worked near Calabogie in 1920. For some time it has been known that this mineral occurs on lot 7, concession X, Bagot township, but no exploitation was attempted until 1919, when the mineral rights to 400 acres were purchased from the Estate of Hiram Robinson, Ottawa, by James E. Wilder, a Montreal merchant. The surface rights are owned by Cyrus Holden.

Mr. Wilder began work on October 1, 1919, at a point a quarter of a mile west of Virgin lake (or Dempsey lake, as it is locally known), and has since built a grinding plant near the pit. When inspected on October 14, 1920, the excavation was 60 feet in length and had a width of 50 feet at one end and 25 feet at the other; its greatest depth was 25 feet. A good showing of celestite was exposed at the bottom of the south face of the pit, but, as the footwall was not visible, it was not possible to determine the thickness; it was, however, at least six feet thick at this horizon. The dip of the deposit, which is vein-like, appeared to be at 45 degrees to the south. The celestite is white in colour, of the fibrous, radiated

habit, and is associated with a little barite; Mr. Bambrick, the superintendent, stated that the barite content runs from 10 to 12 per cent. There are some horses in the vein consisting of carbonate of a pale pink color; in the face seen these horses were comparatively few in number and the largest was two feet in its greatest dimension. Celestite in small quantities is exposed at several other places on the property, but not enough work has been done to determine whether these outcrops are connected with deposits of any importance. One core-drill hole was put down on the deposit first mentioned and now being worked; at 40 feet celestite was encountered and persisted to 60 feet where drilling was stopped owing to the loss of the bit. The owner intends to sink a slope from the bottom of the pit.

The celestite is crushed in a 6-inch by 8-inch Wettlaufer jaw crusher and then ground in a Sturtevant vertical rock emery mill. The fines are lifted by a fan and the remainder of the product is elevated to a bin. The next stage of the grinding is done in a Sturtevant horizontal rock emery mill which discharges into a cone and the fines from this grinding join those produced in the first mill. The product and the fines from both mills are bolted in two bolting machines, the oversize being returned to the horizontal mill. The ground celestite is all sold to paint manufacturers.

Additonal machinery on the property includes: a return tubular boiler, a threshing boiler, a steam engine and a contractor's hoisting engine.

Joseph Bambrick was in charge and had eleven men employed.

Corundum

Corundum Limited.—This company operated its mill at Craigmont for six months during 1920 treating tailings leased from the Manufacturer's Corundum Company, Limited. A recovery of 2.57 tons per 100 tons tailings treated is being obtained.

The capacity of the plant has been increased from 100 to 130 tons per day, operations being carried on for 24 hours per day. Thirty-five men were employed.

The officers of the company are: president, N. C. Harrison, 209 Washington St., Boston, Mass.; general manager, E. B. Clarke, Craigmont, Ont.

Feldspar

Allan.—North Burgess township, concession X, lot 12. The deposit of feldspar on the J. K. Allan farm at Allan Mill, six miles from Perth, was tested for two months by the Silica Milling Company, Monadnock Building, Chicago. Work was stopped in February, 1920. Michael P. Powers of Perth was in charge.

Cecebe Lake.—W. B. Woods, 305 Board of Trade Building, Wheeling, W. Va., shipped 722 tons of feldspar from a vein on lot 26, concession II, township of Chapman. The vein is near Harlem's wharf on Cecebe lake, an expansion of the Maganatawan river, and is nine miles west of Burks Falls. A scow is being built to transport the feldspar to Burks Falls during the season of 1921.

Towards the end of the year, the Wheeling Feldspar Company was incorporated to exploit the property.

Dillon and Mills.—W. A. Dillon and W. A. Mills worked three feldspar quarries near Hybla, Ont., during 1920, all shipments being made to the Feldspar Milling Co., Toronto.

Two of these were on the W. H. McCormack farm. From the first on that part of lot 22, concession VI, township of Monteagle, lying west of the Central Ontario Railway, 16 cars were shipped.

The second desposit, from which 4 cars of feldspar were shipped, was on the west half, lot 24, concession VI, township of Monteagle.

The third deposit worked was on the farm of Geo. Watson, on the south half lot 21, concession VII, township of Monteagle. Six carloads of feldspar were shipped.

Ten men were employed. Early in 1921 this firm did some prospecting work on the Carfare farm, lot 5, concession XII, township of Faraday. This is about 3 miles south west of Bancroft, Ont.

P. J. Dwyer.—In March, 1921, P. J. Dwyer, 59 Yonge St., Toronto, resumed work with a force of 5 men under foreman J. McDonald, on a feldspar deposit in the farm of Harry Plunket, in lot 20, concession VI, township of Monteagle. Work consisted of stripping along 200 feet on a vein which appeared to be from 20 to 25 feet wide. A 30 h.p. vertical boiler was being put in position to supply steam for drilling.

One carload of feldspar was hauled to Hybla, a mile and a half distant, and shipped by C. N. railway.

Eureka Flint and Spar Co., Limited.—This company was one of the largest shippers of spar from Ontario in 1920.

The Emery quarry near Verona was the source of most of the supply, and was worked during the whole year. About fifteen men were employed. This quarry is in the west half of lot 16, concession XI, township of Portland.

This company also opened a new deposit of feldspar on the farm of Edward Finn, half a mile southeast of Wilkinson station on the Canadian Pacific railway. The vein is on lot 3, concession X, Hinchinbrook township. A plant, consisting of a Stroudsburg Engine Works contractor's hoist and vertical boiler, and a derrick, was set up. Shipments were made for a couple of months and work was then stopped.

The grinding works of the company are at Trenton, N. J. John Wilkes, 39 Logan Avenue, Trenton, N. J., is field manager and Richard Wagar, Verona, Ont., is foreman for both the Emery and the Finn quarries.

Feldspar Milling Co., Limited.—The feldspar-grinding plant of this company at Drafton siding near Tichborne was in operation until July, 1920. The machinery was then removed to Ashbridge bay, Toronto, where it is said to be grinding feldspar. The late F. H. Hurlburt of 33 Richmond St. West, Toronto, was president of the company.

Feldspar Quarries, Limited.—In 1920 Feldspar Quarries, Limited, carried on work at the Brebner and Timmins feldspar quarries near Verona and purchased the O'Holloran feldspar mine near Perth. The company was reorganized at the end of the year and the following officers were appointed: president and managing director, W. H. Despard, 48 Crescent Road, Toronto; treasurer, Donald A. Cameron, Toronto; secretary, Miss N. F. Martin, Toronto; manager, Gordon C. Edwards, Verona.

The Brebner quarry (also known as the "Bauder" or "Gamey") is in lot 4, concession XII, Portland township, and was worked until September 1, 1920.

The Timmins feldspar quarry is a new one in part of lots 17 and 18, concession, XI, Portland township, on the farm of John Timmins. Work was carried on from April to September, 1920, and was resumed in January, 1921. The plant consists of a Beatty and Son's contractor's hoist, two vertical boilers, a locomotive-type boiler and a derrick. At first the vein contained a high percentage of quartz but when last inspected it looked much more promising, as the quartz seemed to be pinching out. Molybdenite is conspicuous in some of the quartz. Twelve men are employed under the direction of foreman Fred Amey of Verona.

The O'Holloran (or Holloran) feldspar deposit is on the farm of Michael O'Holloran in lot 1, concession II, Bathurst township, and is a short distance south of Christie lake. Gordon C. Edwards bought the mining rights from Joseph H. Mendels of Perth and began mining in July, 1920. Mr. Edwards put in a plant consisting of a contractor's hoist and vertical boiler, a horizontal tubular boiler, a horse whim and a derrick. At the end of the year Feldspar Quarries, Limited, acquired control and continued to work the property. The feldspar is hauled two and a half miles to Elliott siding, eight miles west of Glen Tay. Eighteen men are employed under the direction of Joseph H. Mendels, superintendent, and Albert McGonegal, foreman. The post office address for the mine is R. R. No. 1, Perth, Ont.

Freeman.—Loughborough township, concession XII, lots 1 and 2, and Portland township, concession XIII, lot 1. During the summer of 1920, W. A. Mills, R.R. No. 1, Hartington, Ont., worked for a short time resorting the dumps at the Freeman feldspar mine. This property was worked in 1902 and 1903 by the Pennsylvania Feldspar Company.

Gardner Feldspar Company.—The Gardner Feldspar Company began to prospect a vein of feldspar two miles northeast of Tichborne, Ont., in the early part of 1920. This is on William Steele's farm and is on the west half of lot 27, concession III, Bedford township. Shipments were made until September, when the quarry was abandoned. Wm. McCharles was foreman and had charge of ten men.

In September the company began to exploit another new property near Holleford. This is the farm of W. J. Babcock and comprises lot 1, the west half of lot 2, and the northeast quarter of lot 2, concession XI, Loughborough, and the east half of lot 3, concession XII, Loughborough. A Beatty and Son's contractor's hoisting engine and vertical boiler and a derrick were transferred from the Steele quarry and put in use. In summer, Hartington is the nearest shipping point and a six-mile haul is necessary; in winter by using a winter road to Verona the haul may be reduced to four and a half miles. When inspection was made on November 29, eighteen men were employed. Gerald B. Emery, R.R., No. 1, Hartington, Ont., is manager and V. A. B. Abrams, foreman.

Hoppins.—Bedford township, concession III, lot 2. The International Feldspar Company, Limited, continued to work this feldspar quarry during all of 1920 and employed 15 men. John A. McLean, 316 Moffat Block, Detroit, Mich., is president of the company, and John J Abrams is superintendent. The postal address of the quarry is R.R. No. 2, Hartington, Ont.

Long Lake.—Loughborough township, concession IX, lot 11. O'Brien and Fowler continued work until July, 1920, on the two feldspar veins mentioned in the Twenty-ninth Annual Report of the Ontario Department of Mines. The property is near Perth Road and the veins are on the shore of Long lake, Frontenac county. N. B. Davis, Union Bank Building, Ottawa, was manager.

In December, Sherman Orser and Dr. S. C. Wilson of Perth, Ont., began work on one of the veins with a force of five men. William Raymond is foreman.

McDonald.—The Verona Mining Company operated throughout the year 1920 at their quarry on the Peter McDonald farm, lot 18, concession VII, township of Monteagle, and a mile and a half east of Hybla Station on the Central Ontario Railway.

The quarry was worked in four benches with faces of 12, 16, 30 and 15 feet respectively. The width of the benches varies from 30 to 60 feet and extends over a length of about 465 feet.

An average of 20 men was employed during the year. The output of the quarry varies from 25 to 45 tons a day, and is shipped via Hybla to Rochester, N.Y.

The officers of the company are: president, S. Harry Worth, Philadelphia, Pa.; secretary-treasurer, M. Moore, Philadelphia, Pa.; general manager, G. Vaughan Baker, Philadelphia, Pa.; superintendent of quarries, Robt. J. Elliot, Hybla, Ont.

The head office of the Company is at 404 Harrison Building, Philadelphia, Pa.

The Sutherland quarry (on farm of Alex. Sutherland), in lot 19, concession VII, township of Monteagle, was worked for a short time during 1920. The vein here is about 30 feet wide and has been opened up over a length of 50 feet and a depth of 12 feet.

McGregor.—Bedford township, concession III, lot 25. The McGregor feldspar mine near Tichborne was bought by Federal Feldspar, Limited, and was worked by this company until November, 1920. The equipment includes two Marsh and Henthorn contractor's hoists with vertical boilers, and two derricks. When the quarry was inspected in August, its dimensions were approximately 100 feet long, 25 feet wide and 6 to 25 feet deep. Fifteen men were employed under foreman William Abel. The head office of the company is at 250 Slater Street, Ottawa and the officers are: president, J. R. Douglas, Ottawa; vice-president and manager, John O'Toole, Ottawa, secretary-treasurer, Harold Fisher, Ottawa.

Morrison, Woods and Eastman.—Early in 1920, two car-loads were shipped to Hamilton from a deposit of feldspar on Chas. Lake's farm, lot 9, concession XII, township of Faraday, about three and a half miles southwest of Bancroft. The quarry face was 30 feet in depth and the opening 150 feet wide. The work was in charge of Thos. Morrison of Bancroft, the other members of the syndicate being William Woods, Hamilton, Ont., and A. M. Eastwood, Hamilton, Ont. Fifteen men were employed for three months in the early part of the year.

This syndicate prospected by stripping and sinking test pits on Sam Robinson's farm, south half of lot 5, lot 6 and 7, concession A, township of Faraday. No shipments were made.

Ontario Feldspar, Limited.—This company worked the Morrow feldspar property near Feldspar, Ont., during the early part of the year. S. H. Orser, Perth, Ont., was manager.

Orser-Kraft Feldspar, Limited.—This is a new corporation with the following officers: president and manager, Sidney H. Orser, Box 99, Perth, Ont.; vice-president, Ed. Erion, Buffalo, N. Y.; treasurer, Leo B. Seitz, Buffalo, N.Y.; secretary, Miss Dencie Orser, Perth, Ont.; directors, Harry N. Kraft and Gustav Metz, both of Buffalo, N. Y. The company is doing work on the three feldspar properties mentioned below.

Morrow.—South Sherbrooke township, concession V, lot 13. This quarry was worked throughout 1920, first by Ontario Feldspar, Limited, and later by Orser-Kraft Feldspar, Limited. Elwood Orser is superintendent and Ernest Newman, foreman. Thirteen men are employed.

Burns.—In July, 1920, this company began to work a pegmatite dike in the east half of lot 2, concession III, township of Bathurst. This dike is beside the Canadian Pacific Railway tracks but as no siding has yet been put in, shipments have to be made from Christie Lake siding a mile and a half to the east. Austin and Hawley shipped quartz from this deposit a few years ago. Orser-Kraft Feldspar, Limited, have a small crew removing a band of quartz preparatory to mining feldspar.

Keays.—In January, 1921, Orser-Kraft Feldspar, Limited, began to open a deposit of white and greenish white feldspar on the Wm. J. Keays property, northwest of Perth. This is situated on the east half of lot 21, concession IX, Bathurst township. The rock on the south side of the vein consists of gneiss, that on the north has not yet been exposed. Six men were drilling by hand under supervision of Creighton Orser. This vein is a wide one, but the seven-mile haul to Glen Tay is a handicap. Apatite was mined on an adjacent property many years ago.

Patterson.—South Sherbrooke township, concession VI, lot 15. A vein of feldspar on the farm of Robert J. Patterson was prospected in a small way by Universal Silicates, Limited, during the early part of the year. Later, L. E. Austin, who mined feldspar near Verona a few years ago, shipped several carloads from this vein.

Rinaldo McConnell.—Rinaldo McConnell of Perth, Ont., shipped feldspar from two quarries in 1920—the Palmer near Feldspar and the Kirkham near Brooke.

Palmer.—South Sherbrooke township, concession IV, lot 10. This quarry, locally known as the "Palmer", is on a farm now being worked by James Morrow. Feldspar was quarried by hand-drilling during the early part of the year and was shipped from Feldspar station a mile distant from the quarry. Six men were employed.

Kirkham.—Bathurst township, concession VII, lot 3. Stripping and preparatory work were done in 1919 and a small quantity of feldspar was shipped. In May, 1920, work was resumed. Power is supplied by a return tubular boiler, and a winch geared to a small horizontal steam engine is used for hoisting. When the quarry was inspected in February, 1921, the excavation on the vein of feldspar was 90 feet long, 22 feet deep at the deepest point, and averaged 20 feet in width. The vein strikes N. 55 E. (magnetic) and contains a good grade of red feldspar. Shipments are made from Bathurst station. The force is in charge of foreman James Benton and consists of twelve men.

The Rock Products Company.—The Rock Products Company, whose works are at Silica, Ohio, mined feldspar in 1920 from a vein on the James Truelove farm in lot 10, concession VI, Bathurst township. Work began in July and continued until the end of the year, when the pit was from 6 to 18 feet wide, 45 feet long and some 20 feet deep. A whim and derrick were used for hoisting. Fourteen carloads of feldspar were mined and shipped from Bathurst station, which is two miles away. An office and a small boarding house were built near the quarry.

In January, 1921, this company began to test another feldspar vein on the Wm. D. Noonan farm, lot 18, concession IX, Bathurst township.

A. G. Minehart, Nicholas Building, Toledo, Ohio, is treasurer and manager of the company, and W. A. Hannah, Wemyss, Ont., is field manager.

South March.—O'Brien and Fowler continued to work the deposits of feldspar near South March station until November 26, 1920. These were in lot 6, concession II and III, March township, and were mentioned in the Twenty-ninth Annual Report. Fourteen men were employed under foreman Charles C. Orser. The largest excavation is 125 feet long, 25 feet wide and 20 feet deep. Norman B. Davis, Union Bank Building, Ottawa, is manager for O'Brien and Fowler.

Spencer and Rose.—Spencer and Rose of Napanee did six weeks of prospecting work on John G. Price's farm, lot 22, concession VII. The work consisted of sinking test pits. No shipments were made. Four men were employed.

Teeples.—In January 1921, Dr. Coon of Elgin, Clarke G. Walton of Elgin and several associates began to test a large deposit of white feldspar on the Alexander Teeples property. The vein, which is in crystalline limestone, is on the east side of Upper Rock lake in lot 8, concession XIII of the township of Storrington. A trial shipment was made from Buck Lake Siding.

Universal Silicates, Limited.—Work was carried on during 1920 by this company on three feldspar deposits on the Geo. Watson farm.

That on the southern part of lot 22, concession VI, township of Monteagle, was worked for three months, beginning in March, 1920. A steam plant used here consisted of a 60-h.p. boiler furnishing steam for a Jenckes hoist, drills and pumps.

Another pit on the northern part of the same lot was opened over a width of 20 feet, 60 feet in length and 35 feet deep.

A third deposit worked on the Geo. Watson farm was located on the western part of lot 21 in the same concession.

12 cars of feldspar were shipped from Hybla Station. An average of nine men was employed.

None of these properties were working at the end of 1920. The holdings of the company are said to have been sold to the American Molybdenites, Limited.

Fluorite

Noyes.—The Canadian Industrial Minerals, Limited, continued work on the Noyes mine near Madoc (lot 13, concession XII, township of Huntingdon), until October 5, 1920, when the mine was closed and all machinery removed.

Drifting was done on the 200-ft level for a distance of 85 feet. At the northwest end of this drift a raise was made to connect with the No. 2 shaft at the 100 foot level. At a distance of 93 feet S. E. from No. 2 shaft on the 200-foot level, a winze was sunk to a depth of 50 feet and on this 250-foot level drifting to the N.W. for a distance of 486 feet was done. Two hundred and ten feet of raising was done on the 100-foot and 200-foot levels.

Ore was mined on the 100-foot and 200-foot levels and 2,528.43 short tons of flourite were shipped. Of this, 2,202.95 tons were sold to consumers in the United States of America, the remainder being sold in Canada.

Forty men were employed, and R. C. Bryden, Madoc, was manager. The head office of the company is 1511-1520, Bank of Hamilton Building, Toronto, Ontario.

Perry.—Cross and Wellington worked the Perry mine on lot 11, concession XIII, Huntingdon township near Madoc, during 1920 with the exception of one month at the beginning of the year. The work consisted chiefly in drifting 110 feet to the southeast (now 170 feet from No. 3 shaft) and in stoping above the 148-foot level. Shipments totalled 1,174 tons, principally to foundries and steel works at Hamilton.

Sixteen men were employed during the year. Henry C. Lloyd was in charge.

Gold

Golden Fleece.—The Cobalt Frontenac Mining Company, Limited, carried on underground development during six months of the year at the Golden Fleece mine, near Flinton. The work of installing the machinery in the new cyanide plant was also continued.

The incline shaft, at an angle of 70 degrees is 100 feet deep. The underground work during the year consisted of about 160 feet of drifting, 220 feet of crosscutting and a raise of 65 feet.

A new unit was installed in the power plant on the Skootamatta river at Flinton, consisting of a turbine and generator of 312-k.v.a., which will be required for the new cyanide mill. Fifteen men were employed during the year.

The officers of the company are: D. H. Fletcher, manager, Flinton; V. A. Burke, secretary-treasurer, Toronto.

Graphite

Black Donald.—The Black Donald graphite mine was inspected on October 13, 1920, when a force of 50 men was employed. Stoping was then being done above the 75-foot level west of the skipway.

In October, 1919, the flow-sheet of the mill was changed and three Callow cells—one roughing and two finishing—were put in use.

In 1920 a two story saw-mill, 24 feet by 62 feet, was built. This contains a 48-inch saw and a planer, driven by a Westinghouse motor.

The mine is owned by Black Donald Graphite Company, Limited, whose head office is at Calabogie, Ont. The officers of the company are: president and treasurer, R. F. Bunting; secretary, J. N. Snead; superintendent, John D. Patno.

Gypsum

Ontario Gypsum Company, Limited.—The Ontario Gypsum Company, Limited, has an authorized capital of 7,500 shares of a par value of $100.00, of which 6,577 have been issued. The officials of the company are: president, Whitney G. Case, Buffalo; secretary-treasurer, Robert E. Haire, Paris, Ontario. In addition the following are directors: O. W. Whitby, Paris, Jas. R. Inksater, Paris, and C. E. Williams, Chicago. R. E. Haire, Paris, is general manager; A. J. Parkhurst, Caledonia, is superintendent; John Renwick is mine foreman at Caledonia and W. A. Parkhurst in charge at Lythmore. The head office is at Paris, Ontario, and the gypsum mines and plaster mills are at Caledonia and Lythmore. An average of 175 men was employed during the year.

An additional 30 acres was bought at Caledonia, lying on the east side of the property and north of the Calinhan lot. The Caledonia holdings now amount to 375 acres. This mine was in continuous operation during 1920 and 84,000 tons of gypsum were hoisted.

An addition was made to the wallboard plant. This was originally the Canada Plaster Board Company, Limited, and was taken over by the Ontario Gypsum Company in December, 1919. In a building 550 feet long, 28 feet wide and 12 feet high, with a grade of 1%, is installed a travelling belt 530 feet long to take the wall board from the mixing and shaping machine, also an automatic cutter and drying kilns. The plant has a capacity of 300,000 square feet per week. The wall board is simply plaster of paris and wood fibre with a heavy paper surfacing and is supplied in length from 4 feet to 10 feet and sold under the trade name of "Gyproc." Gypsum boards 32 inches by 36 inches are also manufactured on this machine. These are used instead of lath by the builders and are plastered upon, and are put on the market as "Gypsum Boards."

At Lythmore the shaft was sunk to the first bed of gypsum at 91 feet and is being continued to 125 feet to open up the second bed. A station and pumping chamber was cut on the first bed of gypsum, which is 11 feet thick. The second bed of gypsum is 4 feet, 6 inches in thickness and is an exceptionally white gypsum. It is expected that this gypsum can be used instead of the white rock now imported by the company from Nova Scotia.

The mill was in operation 4 months on gypsum shipped from the mine at Caledonia.

Iron Pyrites

Grasselli.—The Grasselli Chemical Company, Limited, operated their mine situated a mile and a half northeast of Clyde Lake siding on the Kingston and Pembroke railway until Sept. 26, 1920, when work was stopped. Clyde Lake siding is at railway mileage 22.5 south from Renfrew.

During 1920, the main or No. 2 shaft was sunk an additional 35 feet. Drifting for a distance of 150 feet to the east and 110 feet to the west together with 120 feet of raising was done on the first level, and 25 feet of drifting was done on the second level.

The tonnage of 991 gross tons of run of mine ore was shipped to the company's plant at Hamilton, Ont.

An average of 39 men was employed. D. S. Tovey, Flower Station, was superintendent.

Nicholls Chemical Company.—The mine and plant at Sulphide operated throughout the year 1920, manufacturing sulphuric, nitric and hydrochloric acids, nitre and salt cake. Ore used was taken from stopes over the 2nd, 3rd, 4th and 6th levels.

In January 1921 a winze at incline of 60 degrees was started from the 6th (575 ft.) level 80 ft. east of the main shaft and was sunk to a depth of 100 ft. Plans were under way for cross-cutting the veins at the new level and for carrying on further prospecting by diamond drilling.

The officers of the company are: president, C. W. Nichols, New York; general manager, A. Neighorn, 222 St. James St., Montreal, Que.; secretary, Thos. F. Burgess, New York; treasurer, James L. Morgan, New York; superintendent, W. H. De Blois, Sulphide, Ont.

One hundred and fifty men were employed in the mine and plant.

Lead

Frontenac.—Kingston Smelting and Refining Company, Limited, capitalized at $1,000,000 has been incorporated to work the Frontenac lead mine near Perth Road but as yet has done only some repair work at the mine. The mine property consists of the south half of lot 16 and part of lot 15, concession IX, and the south half of lot 14, concession X, Loughborough township.

The officers are: president, Dr. E. D. Chaplin, New York; 1st vice-president and manager, Alex. McKinnon, Kingston, Ont; 2nd vice-president, S. V. Gavito, New York; director, J. Pina, New York; secretary, J. M. Israel, New York. The head office is in Kingston, Ont.

Kingdon.—The lead mine, concentrator and smelter of the Kingdon Mining, Smelting and Manufacturing Company, Limited, at Galetta was operated throughout 1920 though intermittently during the first six months of the year.

The main shaft was continued to a depth of 418 ft. and a level made at the 400 ft. depth. Drifts were run 278 ft. east and 276 ft. west from the shaft on this level. On the 3rd level (313 ft.) drifts were continued to a distance of 416 ft. east and 485 ft. west from the main shaft.

Stoping was carried on above the 3rd and 4th levels and ore withdrawn from the stopes above the 1st and 2nd levels.

An electric driven 550 volt 3 stage centrifugal pump with capacity of 300 gals. per min. was installed at the 400-foot level during the early part of the year.

During the year the mill treated 26,334 tons of ore yielding 1,572.95 tons of galena concentrates. There were 150 tons of zinc concentrates containing 44.5 per cent zinc shipped in 1919 to the Grasselli Chemical Co. at Cleveland, Ohio.

At the smelter, the 10-ton refining kettle was replaced by one of thirty ton capacity. A quantity of 1140.73 tons refined lead was produced during the year and the grey slag from the Scotch hearth was stored for further treatment.

All machinery on the property except haulage from mill to smelter is electrically driven. Power is obtainable from the Galetta Electric Power and Milling Co., Ltd., whose generating station is on the Mississippi river about 1½ miles from the mine. This power is transmitted at 2200 volts and is transformed at the mine to 550 volts.

During the year a new dry house was erected near the main shaft and six dwelling houses were erected for employees. A. G. Munich, 314 Beaver Hall Hill, Montreal, Que. is managing director and C. H. Thompson, Galetta, Ont. is superintendent of works employing 105 men.

Murphy.—In the Twenty-ninth Annual Report of the Bureau, mention was made of a galena prospect, locally known as the "Murphy lead mine," in Bedford township, county of Frontenac. This is on the south half of lot 17, concession VI.

McLaurin Development Company, Limited, was incorporated on November 21,1919, with an authorized capital of $50,000 to work this prospect. The officers are: president, J. D. McLaurin, South Orange, N. J.; manager, M. W. Wambaugh, 616 Eastgate Avenue, St. Louis, Mo.; superintendent, Conrad Koehler, Godfrey, Ont.

When inspection was made on July 29,1920, a vertical shaft had been sunk to a depth of 40 feet, but only the collar had been timbered. This shaft is on a vein of calcite through part of which galena is disseminated. The wall rock is crystalline limestone. The following machinery was set up in June, a Marsh and Henthorn hoisting engine, a 20-h. p. crude oil engine ("Munktell's motor") and a Sullivan 8-inch by 8-inch air compressor. Six men were employed until August 10, 1920, when all work was stopped.

Marble

Pontiac.—In May, 1920, Pontiac Marble and Lime Company, Limited, started a new quarry on the farm of Arthur Gould, in lot 20, concession V, Ross township. The stone is a coarse-grained white marble and is being sold to George Froats and Company, Renfrew, Ont., for monuments. Haleys, a Canadian Pacific station, three and a half miles distant from the quarry, is the nearest shipping point. Wesley N. Dawley of 381 Lisgar Street, Ottawa, the vice-president of the company and a stone-cutter by trade, is in charge of the quarry. When inspection was made on October 15, four men were employed.

Mica

Aylen Lake.—Mica was produced during part of 1920 from a vein near the north end of Aylen lake in lot 9, concession XIII, Dickens township, and about a mile south of the Algonquin Park boundary. The property may be reached by walking a mile and a half from Opeongo station on the Canada Atlantic division of the Canadian National Railways to the south end of Aylen lake, and thence taking a boat to the mine.

Opeongo Mica Mines, Limited, of which company Thomas A. Low, Renfrew, Ont., is president and manager, began work on the vein in November, 1919, under an option to purchase and built a comfortable camp and office on the shore of the lake.

The property was inspected on May 26, 1920, and up to that date 160 barrels of rough-cobbed muscovite had been shipped. This was obtained from two pits, 125 feet apart, neither of which was more than 18 feet deep. The vein is a pegma-

tite in a biotite-gneiss and in the pits is from 12 to 14 feet in thickness. It has a dip to the west varying from 10 to 30 degrees. In the autumn, work was stopped as the venture was no longer paying. Charles A. Prudhomme of Ottawa was in charge of the work and had a force of sixteen men employed.

As there are many pegmatite veins near Aylen lake, very few of which have been prospected, the district seems well worthy of the prospector's attention. Feldspar might be shipped from some of these veins if freight rates permitted.

Coombs.— A small quantity of mica was mined by "The Coombs Mines" at the north end of Otty lake, three miles southeast of Perth, Ont. This was obtained in the north half of lot 25, concession VIII, Elmsley North; the surface rights until recently belonged to James Oliver but are now owned by Roy Darou. Prospecting was started in October, 1920, and several pits were sunk on mica-apatite pyroxene occurrences.

Inspection was made in February, 1921, when five men were engaged in cutting timber, but no mining was being done. The deepest working was a pit, filled with water and said to be 50 feet deep, on the shore of a creek.

H. L. Coombs, president of H. L. Coombs Co., Limited, Dominion Express Building, Montreal, is behind the venture, and H. G. Wildman, R. R. No. 5, Perth, Ont., is supervising the work.

Ess Creek.—The Standard Mica Company of Chicago stopped work in March on the pegmatite vein near Ess Creek station, 25 miles east of Capreol. This claim was being exploited for muscovite and was mentioned in the Twenty-eighth and Twenty-ninth Annual Reports of the Ontario Bureau of Mines.

Lacey.—The Lacey mica mine, near Sydenham, in lot 11, concession VII, Loughborough township, was worked throughout the year by the Loughborough Mining Company, Limited. This mine still yields large quantities of high-grade phlogopite of both the amber and milky varieties. George W. McNaughton, Sydenham, Ont., is manager, Richard Smith superintendent, and Thomas Stevenson foreman.

Orser Mica Company.—The Orser Mica Company, of which Sidney H. Orser of Perth, Ont., is manager, worked intermittently until August, 1920, on two mica properties under lease—the Bedford, or Folger mine and the Connors and Daly mine.

The Bedford mine is near Glendower in lot 5, concession II, Bedford township and was described in the Twenty-ninth Annual Report. Frank J. Judge was foreman.

The Connors and Daly mine is near the west end of Devil lake in lot 6, concession VIII, Bedford township. Several of the numerous pits on this property were cleaned out and a few barrels of dark amber mica were shipped. There is no machinery at this mine. James Campbell was foreman.

Taggart.—The Taggart mica mine is owned by Kent Bros. and Stoness, Kingston, Ont., and has been worked by this firm since 1903. It is situated on the south side of Mud bay, Bobs lake, and is in lot 30 or lot 31, concession VI, Bedford township.

A large number of narrow parallel veins, striking northeast and southwest, have been found, and on these veins nine pits, more than 30 feet deep, have been excavated. In 1919, two pits, known as the Taggart and the Jones pits, were worked; in 1920, mining was confined to the Taggart pit. The Jones pit is 75 feet long and 100 feet deep; the Taggart pit, when inspected in August, 1920, was 60 feet long, 90 feet deep and averaged 5 feet in width. The mica obtained is of

the amber variety and after rough-cobbing is shipped from Crow lake station to Kingston for trimming. The mine machinery consists of a small marine boiler, an 80-h.p. locomotive-type boiler and an Ingersoll Rock Drill Company hoist. Eight men were employed at the time of inspection under the direction of superintendent Charles A. Stoness and foreman John A. Badour. The nearest post office is Crow Lake.

Tett.—Steve Bennett, of Westport Ont., worked the Tett mica mine under lease for a short time in 1920. It is the property of J. P. Tett and Bro. of Bedford Mills, Ont., and is in lot 24, concession VIII, Bedford township.

Phosphate

Silver Queen.—The Silver Queen phosphate and mica mine in lot 13, concession V, township of North Burgess was closed down in the spring of 1920. It was being worked by the Dominion Improvement and Development Company as mentioned in the Twenty-ninth Annual Report of this Department.

Talc

Connolly.—The Anglo-American Talc Corporation, Limited, operated the Connolly talc mine near Madoc for 250 days in 1920 and employed 25 men, 16 of these being in the mill.

The Connolly is the N.W. ¼ of lot 15, concession XIV, Huntingdon township.

Stoping was done between first and second levels and between second and third levels. About 6,000 tons of talc were produced. During the year a Canadian Check Rand compressor-16 x 18 x 16, type P. L. B., 2—capacity 783 cubic feet, was installed to supply air for the mine. This is driven by a 100-h.p. motor (Canadian General Electric). In the mill a second tube mill 6′ x 24′ was added.

The officers of the company elected in August, 1920, were: president, Victor Crawford, 120 Broadway, New York; vice-president, H. S. Predmore, Madoc, Ont., secretary, F. L. Deutsch, 120 Broadway, New York; superintendent, Thos. Carswell, Madoc.

On March 1, 1921, the name of the company was changed to the Asbestos Pulp Co.

Eldorado.—The Eldorado Mining and Milling Company, Limited, operated during 1920 until the middle of October.

Chas. Brent was manager and Robt. M. Phillips, superintendent. Thirty-five men were employed in the mine and mill.

George H. Gillespie and Company.—The talc mill at Madoc was in continuous operation in 1920 until the latter part of December and employed 22 men.

George H. Gillespie is manager and L. A. Ashley, mill superintendent.

Henderson.—The talc mine of the Henderson Mines, Limited, at Madoc operated during the year 1920 until Dec. 24, with a force of 14 men. All the talc was mined above the 200-foot level and was hauled to the George H. Gillespie & Company's mill at Madoc Station.

A new shaft was sunk 240 feet in the south wall between Nos. 1 and 2 shafts. Crosscutting, 40 feet, was done from the shaft in the direction of the ore body. When completed, this will form the main working shaft for the mine.

Edward Phillips is superintendent.

Price.—In the fall of 1920, a test pit about 20 feet deep was sunk on the Price lot directly east of the Connolly on what was said to be an extension of the Connolly vein.

QUARRIES, CLAY AND GRAVEL PITS

Granite and Syenite

Appleby and Hutcheon. Mark Appleby and Andrew Hutcheon, two Gananoque quarrymen, got out paving blocks during the summer of 1920 on the John Carey farm, a short distance south of Findley station. This farm is in lot 31, concession IV, township of Pittsburgh. The rock is a red granite.

Alex. C. Brown.—Alex. C. Brown of Lyndhurst has been operating a quarry on the Alex. Bruce farm in lot 10, concession IX, Leeds township. Red granite monument stone is produced and hauled 7½ miles to Lyndhurst for shipment. The quarry was started in the fall of 1918. Eight men were employed when the quarry was inspected on August 13, 1920. The blocks of stone were being hoisted by means of a horse whim and a hand winch.

Robert Brown.—West of the A. C. Brown granite quarry is another being worked by Robert Brown of 376 Sparks Street, Ottawa. This stone is also red granite and is shipped rough from Lyndhurst to be made into caps, dies and bases for monuments. The quarry is on the Clifford Earle farm in lots 9 and 10, concession IX, Leeds township; it was opened some thirteen years ago by Alex. Bruce and A. E. Gordon. When inspected in August, 1920, there were four men employed under foreman Harvey C. Lester of Lyndhurst. The plant consisted of three derricks, a Canadian Ingersoll Rand 8-inch by 8-inch compressor, and a Goold, Shapley and Muir Company gas engine.

Butler.—In 1916 Wm. Horne opened a quarry at Butler siding, nine miles west of Ignace and since that has carried on work every summer. Monument stone, paving blocks and dimension stone are produced. The rock is a granite varying from light gray to almost white in color. About ten men are employed. Mr. Horne's address is Ignace, Ont., or Suite 31, Ross Apartments, corner Home and Preston Streets, Winnipeg.

David J. Gordon.—For the past three years David J. Gordon of Gananoque has been quarrying monument stone from the farm of Joseph Marshall, lot 3, concession V, Leeds township. When inspected on August, 1920, four men were employed and the hoisting was being done by means of a Beatty and Sons horse whim. The rock is a greenish gray syenite. Shipments are made from Cheeseboro station on the Grand Trunk, five miles distant from the quarry.

Street and O'Brien.—The firm of Street and O'Brien (William Street and Kennedy O'Brien), Box 73, Gananoque, Ont., have been quarrying near Gananoque for some years. At the present time they are producing paving blocks and some dimension stone from a quarry which was opened some twelve years ago on the farm of James Bell, in lot 6, concession II, Leeds township. The rock is a granite, gray and red in colour. Shipments are made from Cheeseboro station, which is about a mile east of the quarry. Eight men are employed.

Silica Sand

Jordan.—In 1920 silica sand was obtained from the south shore of Christie lake on the farm of John Jordan. It was shipped from Elliott siding to Montreal by J. C. Fowle of Montreal.

Ontario Rock Co.'s trap-rock quarry near Havelock, Ontario.
The view shows a 60-foot quarry face before explosion on April 29th, 1921.
Entrances of two blasting adits are shown at base.

Trap

Ontario Rock.—The Ontario Rock Company operated its trap rock quarry near Havelock from January to December, 1920, and shipped 42,000 tons of trap rock. Shipments were curtailed owing to lack of railway cars. Additions to the plant include a 48-inch by 60-inch jaw crusher, a 48-inch belt conveyor, a 6-foot by 16-foot revolving screen, a Model 61 Marion shovel, two dinkeys and six yard cars. The plant has been electrified and is now using 600-h.p. obtained from the Hydro. A new quarry face has been opened up on a level with the jaw crushers.

The officers of the company are: Alex. Longwell, president, Toronto; G. W. Rayner, vice-president and general manager, Toronto; W. W. Wallace, superintendent, Preveneau

General view of crushing plant and quarry, showing explosion.

Quarry after explosion in which 26,000 cubic yards of trap rock was broken in one blast by the use of 240 cases of 60 per cent dynamite and 120 cases of black powder.

Limestone

American Cyanamid.—The American Cyanamid Company began operating a quarry on December 1, 1920, on a property leased from the Beachville White Lime Company on lot 16, concession III, township of North Oxford.

The quarry has a face of 21 feet. The plant consists of 1 cyclone drill, 1 boiler, of 45-h.p., 1 derrick hoist, and 2 pumps, 3-inch and 5-inch. The material is loaded directly into cars ond shipped to the company's plant at Niagara Falls, Ont. An average of 22 men are employed.

The officers of the company are: E. D. Hallam, manager, Niagara Falls, Ont.; A. J. Kennedy, superintendent, Beachville.

Beachville White Lime Co.—The limestone quarry at Beachville was operated continuously throughout the year. The quarry has a face of about 38 feet and work was started to descend to a depth of 50 feet.

The annual production amounted to 95,000 tons of stone and 3,180 tons of white lime. The stone was shipped to the Steel Company of Canada, Hamilton, to be used as a flux, to the American Cyanamid Company at Niagara Falls, and to sugar refineries. An average of 47 men was employed.

The officers of the company are: M. S. Shell, president; C. E. Downing, manager; J. H. Blow, secretary-treasurer.

Britnell and Company, Limited.—The quarry at Burnt River, Ont., was operated by this company from April 12 to November 30 in 1920. The work was carried on in two benches, the upper on a bluish limestone 13-foot face and the lower on a reddish limestone 11-foot face. Output consisted entirely of crushed rock, shipments being made by G. T. R. The quarry lies directly west of the Lindsay-Haliburton line.

An average of 18 men was employed. Wm. Britnell was manager at the quarry and Robt. Craig foreman.

Brunner Mond Canada, Limited.—This company operated the quarry and crushing plant near Amherstburg (lots 6, 7, 8, concession I and lots 2 and 3, concession II, township of Anderdon) continuously throughout the year 1920. The property was formerly owned by T. B. White.

The quarry is worked on two benches, so that stone from two limestone beds is taken out. The lower bed owing to the higher calcium content supplies the more desirable stone for the company's alkali works and it is principally for this stone, locally spoken of as "soda stone," that the quarry is operated. The lower bed is 26 feet deep and the upper bed varies between 18 and 35 feet.

The overburden on the rock is removed by a Marion steam shovel, model 28. Drilling for deep holes is done by means of well drills driven by electric power. Rotary pluggers are used for block holing. Air for the latter drills is supplied by an Ingersoll Rand 10 x 10 air compressor driven by a 35-h.p. Crocker Wheeler a. c. motor, 440 volts.

The broken rock in the quarry is loaded into 7-ton side-dump cars by a Marion steam shovel, model 61. The cars are then hauled by a locomotive (Shay type) from the quarry face to the foot of an incline leading to the crushing plant. Each car is then hauled up this incline (20% grade), by a hoist driven by a 112-h.p. motor.

The car is dumped by an air lift and rock is fed directly into a No. 11 McCully gyratory crusher, which is driven by a 100-h.p. motor. From this crusher, the stone passes to a bucket elevator, which raises it to two sets of sizing screens, each with three sections— 2-1, 1-½, ½-dust. Screens and elevator are driven by a 50-h.p. motor.

Owing to requirements of the alkali plant, the stone from the two beds of the quarry is crushed separately. Everything in size from six inches to one inch from the lower bed is sent to the alkali plant to be calcined. Anything under one inch, is passed on after crushing to be mixed with the crushed stone from the upper bed.

After screening, the crushed stone is conveyed to bins from which it is loaded into railroad cars. The company has its own switching service for rock used in the alkali plant, which is a mile west of the quarry.

The crushing capacity of the plant for commercial stone can be materially increased, as a No. 7½ McCully gyratory crusher and screens have been installed. This unit can be used to crush oversize from the other sets of screens, but was not in continuous operation during the year.

The output of the plant in 1920 was 500 tons a day. Thirty-five men were employed in the quarry and crushing plant.

The officials of the company are: G. N. Comly, manager; J. C. Garrels, assistant manager; W. H. Clarey, chief engineer and Jas. J. Meehan, superintendent, of quarry and crushing plant. Offices are at the alkali plant near Amherstburg Ont.

Canada Cement Company, Limited, Plant No. 8.—The cement plant at Port Colborne was operated at full capacity during the year 1920. The quarry is situated on the north side of the Grand Trunk railway and has a working face of about 18 feet. A new quarry was also opened up on the opposite side of the railway and will have a face of about the same height. During the year 130,000 tons of stone and 20,000 tons of clay were delivered to the plant.

The equipment consists of two Marion shovels and two cyclone drills in the quarries and one locomotive crane with a 1-yard orange-peel bucket used in stripping. A new McNyler Whirley steam shovel was purchased for use in the clay pit. The material is hauled to the plant by three locomotives.

A new plant for the recovery of potash was completed and put into operation about December 15. The dust from the four kiln stacks is drawn by one large fan nto two duplicate chambers. The dust is precipitated by fifty sprays of water in each chamber.

An average of 25 men was employed in the quarry and clay pit.

L. M. McDonald is superintendent.

Canada Crushed Stone Corporation, Limited.—The quarry at Dundas was operated during the year with greatly increased capacity. The shortage of railway cars at the time of greatest demand, however, considerably curtailed shipments.

The quarry is about 1,100 feet in length, varies in width from 200 to 450 feet, and is worked in three benches. The upper bench has a face of 35 feet, the material from which is delivered to blast furnaces for fluxing. The two lower benches, each with a face of 20 feet, are quarried and the rock crushed for concrete and road building. The drilling is done by ten electric cyclone drills and material loaded into cars by three steam shovels. An electrically driven shovel is also used for stripping. The material is hauled to the plant by six locomotives and crushed first by a No. 10 McCully gyratory crusher driven by a 250-h.p. motor. From the first crusher it is conveyed to two 76-inch crushers which reduce it to commercial size. It is then conveyed by two thirty-inch belts to four revolving screens 48 feet by 4 feet. The oversize goes to 36-inch Garfield rolls and is again elevated to the screens. The sizes 1-inch and ½-inch again pass over shaking screens to complete the removal of fines. From the screening plant the rock is conveyed in bins, which have a capacity of 10,000 tons. The rock is loaded into cars drom the bins or carried to the stock piles. During the year a new conveyor plant was built, which carries the crushed rock from the bins to the stock piles. A 24-inch belt carries the material 500 feet, when it is deposited on a second belt equipped with an automatic trip which deposits the rock in the piles. The conveyor has an elevation of 90 feet and 75,000 tons can be kept in stock. A concrete tunnel, 12 feet by 12 feet and 400 feet in length, runs beneath the piles. The rock is fed from chutes on to a 30-inch belt and is carried through the tunnel and elevated to bins. The material may be run through a revolving screen 4 feet by 2 feet before going to the bins. From the bins the material is loaded into cars or trucks.

The plant has now a capacity of about 60,000 tons per month and during the year a total of 450,000 tons was shipped.

The firm employed an average of 88 men.

The officers are: C. M. Doolittle, president and general manager; J. B. Hart, secretary-treasurer and assistant manager; George Gruhl superintendent.

Cayuga Stone Company.—This company started a new limestone quarry in 1920 in lot 48, concession I south, township of Cayuga North. The property consists of ten acres, is half a mile east of Nelles Corners, and across the road from a quarry owned by the county of Haldimand.

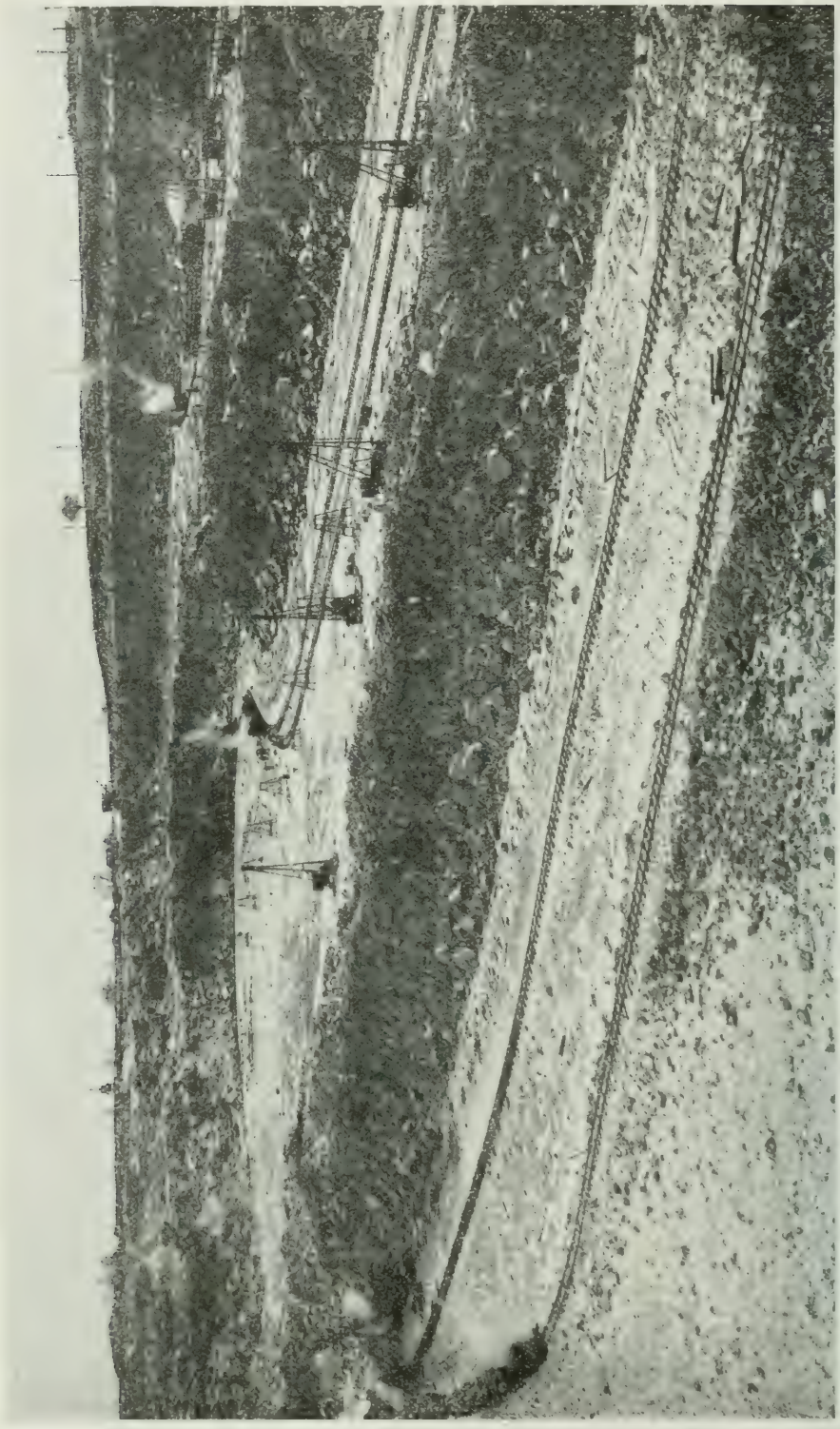
When inspection was made in July 21, 1920, a little stripping and blasting had been done and the machinery was being set up. The latter consists of: a McIntosh, Seymour and Company engine, a 110-h.p. Jenckes return tubular boiler, a Beatty and Sons three-drum contractor's hoist with vertical boiler, a Domionion Road Machine Company No. 5 Champion crusher with 14-inch by 26-inch jaw opening, and an Austin No. 4 gyratory crusher. The rock produced will be used for road making. Twelve men were employed.

H. B. MacConnell, Cayuga, Ont., is secretary-treasurer of the company and William Hicklin, Hagersville, Ont., is manager.

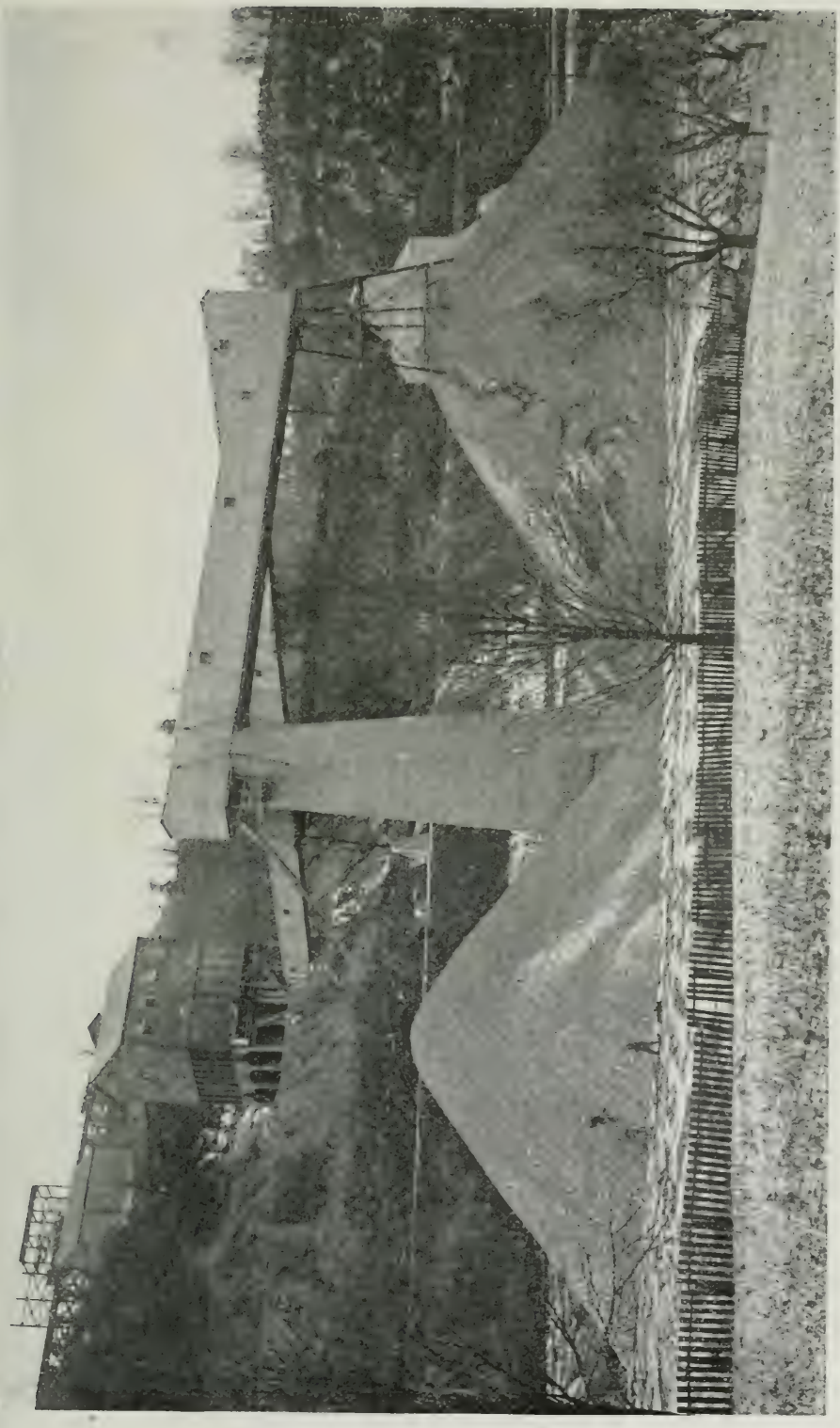
Crushed Stone, Limited.—The limestone quarry of this company near Kirkfield in Victoria county was operated continuously in 1920 from May 5th to the end of the year.

80,000 tons of crushed tock were shipped or stock piled. Shipments from the plants were seriously curtailed by a shortage of cars. Early in 1921, two Fulles mills were installed to take the place of Emery mills for the grinding of limestone grit. The dust (80 per cent through 200 mesh screen) from these mills is bagged and shipped for use in asphalt paving. The capacity of the mills will be 50 tons a day.

William T. McRae, Kirkfield, is superintendent and had 30 men employed.



Dundas quarry of the Canada Crushed Stone Corporation, Ltd., where 6 locomotives, 3 steam shovels and 12 well drills are operated.



Stock pile (100,000 tons storage capacity) of Canadian Crushed Stone Corporation, Ltd., at Dundas, Ont.

Christie, Henderson and Company.—The limestone quarry at Christie, on the Canadian Pacific railway west of Milton, was operated during the year 1920. The plant consists of three kilns, only one of which, however, was worked during the winter months. The quarry has a face of 70 feet and is drilled by a cyclone well drill. It produced 265 cars of lump lime.

The officers are: D. D. Christie, president; W. P. Gamble, manager; W. Priest, superintendent.

Coldwater.—The limestone quarry near Coldwater, Ont., was worked during nearly all of 1920 by the owners, George Higginson and Son of Coldwater. The excavation at this quarry now covers nearly two acres. A face of about 24 feet is being carried. The quarry property is in lots 19 and 20, concession XII, Medonte township.

John S. Cook and Son.—John S. Cook and Son, Wiarton, Ont., operate two dolomitic limestone quarries near that village in lots 7 and 8, concession XXIV, township of Amabel. These are remarkably good quarries. The beds are uniform and a large proportion of flag stones, sills, coursing stone, etc., is produced.

Elora.—The quarry, kilns and hydrating plant of the Elora White Lime Company, Limited, were operated until May 23, 1920, when the hydrating plant was destroyed by fire. The property of the company was then taken over by the Alabastine Company of Paris, and an up-to-date hydrating plant with storehouses was erected, and operations continued to the end of 1920.

The quarry from which the limestone is obtained is on the south bank of the Grand river, half a mile west of the town of Elora, and has a face of 28 feet. The limestone is high in magnesia containing 45.81% magnesian carbonate and 52.58 % calcium carbonate. Drilling is done by cyclone drill and jack hammers. The stone is hauled in three-ton cars from the quarry up an incline to the top of the kilns.

There are five steel Arnould (steam burner) kilns, coal fired with firing floors 14 feet wide and 75 feet long.

The hydrating plant adjoins the kilns, and includes a lime floor in a one-story building, 45 feet by 75 feet; a three-story main building, 30 feet by 75 feet and a two-story storehouse, 28 feet by 130 feet. The buildings are all gypsum board lined and covered.

The lump lime drawn from the kilns is carried in buckets on a trolley to the lime floor, where it is dumped for cooling. When cooled, the cores are sorted from lime fit for hydration. The former, from which agricultural lime is made, is first crushed in an 8 x 10 Sawyer Massey jaw crusher, and then passed on a conveyor belt to a K-B pulverizer (hammer mill) and when reduced to three-eighths inch size is bagged or stored in bulk. The lime to be hydrated is passed directly from the lime floor to the K-B pulverizer by an 18-inch conveyor belt without preliminary crushing.

In this pulverizer, the lime is reduced to such a size that it will pass a three-eighths inch ring. It is then raised in a bucket elevator to a square bin of 60-ton capacity. From this bin the lime is fed to a 20-inch conveyor belt, to which is attached a poidometer or automatic device for weighing the correct amount of lime to be passed for hydration (slacking of the crushed lime by addition of proper amount of water) to a No. 2 Schaffer hydrator, capacity 10 tons per hour. Steam

generated in hydration is passed out through a stack over the machine and the cool dry hydrate is delivered from the hydrator to a Raymond mill (No. 0) by means of a screw conveyor.

The equipment of the Raymond mill includes the 8-exhaust fan, the pulverizer or beater which knocks the good hydrate free from impurities, the automatic throwout attachment in which the impurities not broken to powder are separated automatically from the grinding chamber, a six foot diameter double cone air separator in which separation of further oversize is made, and a six foot dust collector from which the finished material (99% through a 100 mesh sieve) is discharged to a 75-ton storage bin. The coarse or impure material separated in the mill is sent back to the agricultural lime bin.

From the 75-ton storage bin, the fine product is passed to a Bates automatic bagging machine. A special valve bag, which is self sealing when filled, is used.

The following is an analysis of the hydrated lime:

	Per. Cent.
Silica	0.48
Iron and Aluminum Oxide	.21
Calcium Carbonate	3.00
Calcium Oxide	45.74
Magnesium Oxide	34.36
Combined Water	16.00
	99.79

The capacity of the plant is 50 tons of hydrated lime and 20 tons of agricultural lime per day. The plant is almost entirely operated by electric power ("Hydro") 550 volts. Besieds this equipment, there are two r.t. boilers, 25 and 15 h.p., to supply steam for the lime kilns and heating, and an 8-inch by 8-inch Fairbanks-Morse compressor, 108 cubic feet per minute capacity, for quarry drills and air.

Direct rail service is obtained by a spur from the C. P. R. (Cataract to Elora line) to the storehouse.

During the year 11 men were employed in the quarry and 33 at the kilns and hydrating plant. T. F. Robinson, Elora, Ont., was manager and Albert Brander oreman of the quarry.

Orangeville Quarry

The quarry and hydrating plant belonging to the Contractor's Supply Company near Orangeville was operated for a short time in 1920 by the Alabastine Company of Paris, following the destruction of the hydrating plant at Elora.

Six men were employed in the quarry, and 15 men at the kilns and hydrating plant under Elmer Senn, R. R. No. 6, Orangeville, Ont.

Gallagher.—The quarry belonging to Gallagher Bros. is located on lot 15 in the sixth concession of Barton township. The drilling is done by steam. The quarry has a face of 25 feet. One kiln, with a capacity of 400 bushels per day, was in operation continuously during the year. Five men were employed.

Gibson.—The Gibson quarries near Beamsville in lots 13 and 14, concession VI, Clinton township, were at one time worked on a large scale for dimension and building stone by the Hon. Wm. Gibson of Beamsville; they now belong to Wm. Sutton of Port Dalhousie. Lincoln county took limestone in May and June from some of the waste dumps at these quarries.

Grenville Crushed Rock Company.—In 1920 this company started a new quarry and erected a crushing plant near Deek's siding, mileage 114, on the Canadian Pacific railway, Montreal to Smiths Falls line. The plant operated for three months in 1920, crushing 80,000 tons, part of which was shipped for ballast, the remainder being stock-piled.

The quarry and plant are in east half, lot 9, concession IV, (Gaw farm) lot 8, concession IV (Hanlan farm), and the south half of lot 8, concession III (Kelsey farm), township of Oxford, Grenville county.

The quarry equipment consists of two well drills driven by 10-h.p. motors (220 volts), a submarine piston drill, steam operated, a Marion Osgood Model 73 steam shovel, a 70-c Bucyrus steam shovel, 25 side-dump cars, capacity 6 cubic yards, a 60-ton Davenport locomotive, and three 26-ton Porter locomotives.

The quarry will eventually be operated on one bench with a 35-foot face. Stone is hauled from the quarry in side-dump cars (standard gauge tracks) to the foot of an incline, up which the cars are hauled by a single-drum reversible Beatty hoist, and then dumped by air into crusher.

The crushing equipment includes a No. 27 Kennedy gyratory crusher, and three No. 37 Kennedy gearless gyratory crushers, two No. 84 Kennedy revoloving screens, 28 feet long, two 36-inch by 12-inch bucket elevators, two 24-inch belt conveyors, and bins, capacity 200 tons. The crushed stone ranges in sizes from 2½-inch to ¼-inch, and is loaded directly from the bins into railway cars for shipment, or is sent to stock pile where one Jordan spreader is used.

The greater part of the plant is at present operated by steam, furnished by three 200-h.p. Polson marine boilers, and one 40-h.p. locomotive boiler for water supply. For driving the crushing plant, a 350-h.p. Wheelock cross-compound condensing engine is used. A Rand air compressor, class B2, is also installed, 12 by 12 by 19 by 18, steam duplex, capacity 708 cubic feet per minute.

A 100-h.p. Wheelock steam engine, 15 inches by 34 inches is used to drive a Westinghouse generator, 75-k.v.a., 3 phase, 60 cycle, 2,200 volts, 900 r.p.m.

During 1920, 100 men were employed in the quarry and on construction. When inspection was made in March, 1921, 50 men were employed under J. B. Bains, Oxford Mills, Ont., as superintendent.

The officers of the company are: president, H. F. McLean; vice-president, George S. Deeks; secretary-treasurer, Colonel C.W.P. Ramsay. The head office of the company is at Smiths Falls, Ontario.

Grimsby.—The county started a new quarry in June, 1920, on the top of the escarpment overlooking the village of Grimsby. This quarry is in lot 9, concession III, Grimsby township. The limestone is broken from the upper part of the cliff and falls upon a ledge from which it is hoisted to the top. The machinery used consists of two small boilers—a vertical and a traction, a contractor's double-drum hoisting engine, a Sawyer-Massey 9½-inch by 20-inch crusher, a bucket elevator and a traction engine. John Lawson of Grimsby was foreman.

Hagersville.—The stone quarry at Hagersville was operated during the greater part of the year 1920 by the Hagersville Contracting Company. The quarry is worked by two electric cyclone-drills and a 2½-yard steam shovel. The material is hauled in cars to the incline and taken up to the crushers, where it is crushed and screened to 4-inch, 2-inch, 1-inch, ½-inch and screening sizes.

The production for the year 1920 was 63,701 tons, which was used in building and road-making. An average of 28 men was employed.

The officers of the company are: president, C. M. Doolittle; superintendent, J. Stevens, secretary-treasurer, W. H. Lindsay, Hagersville.

Haldimand County. In 1920 the county of Haldimand worked two limestone quarries for road metal, one at Nelles Corners and the other near Dunnville. Both were in charge of the county road superintendent, David W. McBurney, Hagersville, Ont.

The first-mentioned quarry is in lot 49, concession I south, in the township of Cayuga North and is about half a mile east of Nelles Corners. The county opened this quarry five or six miles ago and has since worked it intermittently. The equipment includes a gasoline-geared hoisting engine, a Sawyer-Massey traction boiler, a derrick, a Sawyer-Massey 8-inch by 16-inch crusher, a trommel and an ore-bin. Fourteen men were employed during the summer under foreman Albert Best.

The Dunnville quarry which is worked by the county is in lot 5, concession I, north side of the Port Dover road, Dunn township. It has been worked for some seven years and is twelve feet deep. The equipment includes a Waterous contractor's hoisting engine and vertical boiler, derrick, Case crusher, trommel, bucket elevator and Sawyer-Massey gasoline tractor. Thirteen men were employed under foreman Albert Schurr.

Hambleton.—The quarry at Hagersville was operated for eight months during the year.

The quarry has a face of about 26 feet, and is worked by a cyclone drill and a No. 75 Marion shovel with a 4-yard dipper; an average of 14 men is employed.

Robert Hambleton, Hagersville, is president and manager.

E. Harvey and Son.—E. Harvey and Son operated one kiln during the year and produced 3,350 tons of lime, which was supplied to the building trade. The face of the pit is from 25 to 40 feet in height, and an average of 10 men was employed.

T. Hanna is manager.

Kingston.—In 1920 Roddy and Monk, 24 Elm street, Kingston, Ont., worked three limestone quarries in the city.

The "Division Street" quarry was worked for dimension stone with a force of three men. This quarry is equipped with two derricks, in connection with which hand winches are used.

The second quarry is on the west side of Montreal street and is worked for road metal only. In this quarry are two crushing plants driven by electric power and each consisting of two crushers, a rotary screen, and two bucket elevators. A traction boiler supplies steam for drilling. Twenty men were employed in this quarry. Directly across the road is another quarry which is owned by the city of Kingston and was worked by Roddy and Monk for crushed rock until December 1919.

The third quarry is on Patrick street and is worked for building and dimension stone. Three men were employed.

Lincoln County.—The county of Lincoln obtained limestone for road building from the three quarries mentioned below. The work was under the supervision of Peter Robertson, county road superintendent, Beamsville, Ont.

Marshall.—The quarry and lime kiln on lot 14, concession VII, township of Barton, of which John Marshall is owner and manager, were in operation for the greater part of the year.

The quarry has a face of from 12 to 20 feet; the rock is hauled by carts to the kiln where natural gas is used as fuel. The production for the year amounted to 28,000 bushels of white lime. Five men were employed.

Oliver-Rogers Stone Company, Limited.—This company operates a large limestone quarry in the eastern part of the city of Owen Sound on Ninth Avenue. Most of the rock is crushed, but building stone is also sold. The quarry is 20 feet deep. Samuel Oliver, 841 Fourth Avenue, Owen Sound, is manager.

The equipment includes the following machinery: one Listowel churn drill, one thresher engine to supply steam for piston drills, one 65-ton Bucyrus steam shovel, two Foden steam wagons, three guyed derricks, and four hoisting engines. In the crushing plant are: one No. 6 Austin gyratory crusher driven by a 100-h.p. motor, one No. 4 McCully gyratory crusher driven by a 30-h.p. motor, two rotary screens and the necessary bucket elevators.

Ottawa Suburban Road Commission.—The commission had two quarries in operation near the city of Ottawa during the winter of 1919-1920, to obtain limestone for road building, namely the McLaurin and Acres.

The work was in charge of Alan K. Hay, engineer to the Commission and W. J. Anderson, master mechanic.

The officers of the Ottawa Suburban Roads Commission are: chairman, John Bingham, Ottawa; Wm. Y. Denison and Warren Y. Soper, respesenting city of Ottawa; F. A. Heney and B. Rothwell, representing county of Carleton; Alan K. Hay, secretary and engineer. The office of the commission is in the Thistle Building, Wellington St., Ottawa. Ont.

McLaurin

The McLaurin quarry is located on lot 3, concession III, Gloucester township. When inspected in January, 1921, a 20-foot face of limestone was being worked. The opening extended 150 feet in length.

The plant consisted of a 30-h.p. Case portable boiler and engine, a 10 x 20 road crusher, bucket elevator, 16 foot screens in four sections and storage bins. Crusher platform was on level with quarry floor and stone was hauled direct to the crusher.

14 men were employed in the quarry and crushing plant under foreman Moses Denis.

Acres

When inspected in February, 1921, the Acres quarry, formerly called Graham's quarry was being re-opened by the Ottawa Suburban Road Commission.

The quarry is located at H. Acres' farm farm on lot 16, concession II, Ottawa front, township of Nepean, to the east of the Richmond road.

20 men were employed in charge of foreman Elijah Dawson.

The face of the quarry is ten feet. Drilling here is done by steam supplied by a 12-h.p. vertical boiler. Power for crushing plant is supplied by a 17-h.p. tractor engine. The crushing plant consists of a 10 x 20 crusher, road type, bucket elevator, screens in four sections and bins. Stone is hauled direct from the quarry floor to the crusher platform.

Pembroke.—Wm. Markus, Limited, has been for some years working a limestone quarry southeast of the town of Pembroke in lot 12, concession I, township of Pembroke. This quarry was at one time owned by Peter White. It is worked principally for crushed rock, but building stone is also produced. The greatest depth to which it has yet been worked is 15 feet.

The crushing and screening plant consists of: an 8-inch by 16-inch Sawyer-Massey crusher, a bucket elevator, a Sawyer-Massey trommel and a 20-h.p. Fairbanks Morse motor.

William Markus, Pembroke, Ont., is manager.

Prescott and Russell Counties.—The counties of Prescott and Russell obtained limestone for road building from the two quarries mentioned below. The work was under the supervision of F. A. Seneeal, county road superintendent, Plantagenet, Ont.

Bourdon

The Bourdon quarry is situated a mile west of the village of Plantagenet Springs station on the C. P. R., short line Montreal to Ottawa. This was formerly known as the Winning quarry, worked for building stone but is now the property of E. Bourdon whose farm is in lot 6, concession II, township of North Plantagenet.

An 18-foot face of limestone was worked. Work began early in November, 1920, and was carried in till April, 1921.

17 men were employed under foreman Jos. Boileau of Plantagenet Springs.

Francoeur

The Francoeur quarry is a half mile from the village of Casselman (G.T.R., Ottawa to Montreal), on the east bank of the South Nation River, and is on the farm of G. L. Francoeur, concession VI, township of Cambridge, Russell county.

A 12-foot face of limestone was worked.

The quarry was worked for the first three months of 1921. Eighteen men were employed under foreman F. Gratton, Casselman, Ont.

Queenston.—The limestone quarry of the Queenston Quarry Company, Limited, near the village of St. David in Niagara township, was in operation throughout the year.

A layer of about 17 feet of gray stone is taken out for crushing; beneath this a face of 15 feet is quarried for building stone.

The plant consists of a No. 5 Austin gyratory crusher, a Simons disc crusher, and screens. The rock is crushed and screened to sizes 3-inch, 2-inch, 1-inch, and ½-inch, and used for road-building, and a small amount for flux.

During the year a new conveyor plant was built which carries the rock by two 20-inch belts, 160 feet and 80 feet in length, to the Michigan Central railway cars, or to stock piles.

The dimension blocks, bases and cut stone are shaped in the mill by two gang saws and one diamond saw. An average of 40 men was employed.

Charles Lowrey is president; R. J. Lowrey, manager; T. W. McKeown, secretary.

Renfrew.—Jamieson Lime Company, Renfrew, Ont., owns and operates two lime kilns, a brick-yard and several crystalline limestone quarries in and near the town.

One quarry is in Renfrew north of the Roman Catholic church. There are two kilns close to the quarry and all the rock quarried is burned to lime.

Nine men were employed under foreman Frank Cabulski.

A second quarry has been recently opened by the company on lot 5, concession II, Horton township. This is east of Renfrew and is on the J. B. McLaren or Frood, farm and on the Du Valiquette farm. In the fall a reinforced concrete lime-kiln was being built.

A third quarry, on the east side of town and locally known as the "third line" quarry, was being worked on a small scale in October. The stone here is, like that in the above-mentioned quarries, crystalline limestone, and an old pit near the present working is said to have been worked by Archie Anderson of Renfrew some twenty years ago for the production of monument stone. Five men were hand-drilling under foreman Michael Switch when inspection was made on October 13.

The company also owns a fourth quarry. This is north of Renfrew on the Jamieson homestead on the east half of lot 14, concession III, township of Horton, but it was not worked in 1920.

Alex. Jamieson, Renfrew, Ont., is manager of the company.

D. Robertson and Company, Limited.—The limestone quarry at Milton Heights was operated throughout the year 1920. The limestone quarry has a face of 70 feet. The quarry for building stone was worked part of the time only. The company produced about 7,100 tons of lump lime, and 60 cars of building and dressed stone.

D. Robertson, Milton, is owner and manager.

Smithville.—In 1919 the county of Lincoln opened a quarry south of and near Smithville in the south half of lot 6, concession IX, Grimsby township. The Dunnville branch of the T. H. and B. railway is beside the quarry. When inspection was made in July, 1920, a 17-foot face of limestone was being worked and the greatest depth reached was 24 feet; the excavation then covered about half an acre. The plant consists of a small vertical boiler, a Sawyer-Massey traction boiler, a Beatty and Sons' contractor's hoist, a derrick, a 10 by 22-inch "Good Road" Goderich crusher, a bucket elevator and a 16-foot screen in four sections. Fifteen men were employed under foreman John A. Miller of Smithville.

Standard White Lime Co.—The Guelph quarry and hydrating plant were worked during the greater part of the year. The plant was reconstructed and new machinery installed to decrease the cost of operations. The hydrating plant has a capacity of 50 tons per day and during the year the production was 978 tons of lump lime and 2,239 tons of hydrated lime. Fifteen men were employed.

The quarry at St. Marys was worked all year and produced 24,013 tons of lump lime and employed 15 men.

The company also operated continuously during the year a lime plant and two quarries at Beachville. The larger quarry on the west side of the property has a face of about 46 feet. The rock is loaded directly into cars by derricks and shipped to the sugar refineries, American Cyanamid Company, and to the blast furnaces for fluxing. A small amount is also sold for the manufacture of fertilizer.

The material from the east quarry is used in making lime and two kilns, each with a capacity of 250 bushels per day, were kept supplied.

An average of 60 men was employed.

Wm. Culford is superintendent.

The officers are: president, E. D. Christie; vice-president and secretary-treasurer, John Kennedy; manager, W. P. Gamble.

St. Marys Cement, Limited.—The quarry at St. Marys was worked continuously throughout the year 1920. It has a face of 86 feet and is worked by two cyclone drills. The rock is loaded into cars by steam shovels and hauled to the incline by two gasoline engines. It is crushed by a Taylor jaw crusher with a capacity of 500 tons per hour, driven by a 200-h.p. motor. From the crusher the material passes through a Mammoth Williams Hammer mill and is conveyed by belt to the mill.

The clay is taken from a pit adjoining the quarry and is loaded into cars by a steam shovel and hauled to the plant by a gasoline engine.

About 150,00 tons of rock and 60,000 tons of clay were delivered to the plant and 22 men were employed.

George H. Gooderham is president and J. G. Lind manager.

Toronto Plaster Company, Limited.—The company operated its quarry, kilns and hydrating plant at Teeswater, Ont., continuously through 1920. During the year, three Crocker Wheeler motors of 50, 40, and 5 H. P. (550 volts) were installed to take the place of steam power. One 90 H. P. boiler is retained to supply steam for the coal fired lime kilns. The entire product of the plant, which has a capacity of 25 tons a day, is shipped as hydrated lime.

Twenty-eight men were employed during the year. D. E. Kennedy, Teeswater is manager and Enoch Erb, superintendent.

Walker Brothers. The Limestone quarry owned by Walker Brothers, Thorold situated in Stamford township, lots 31 and 32, Concession IX, was operated continuously during 1920, producing crushed stone for highway work and limestone for pulp mills. About three quarters of the output goes to the latter. A spur line from the Niagara Falls, St. Catharines and Toronto railway at Thorold runs to the quarry.

The machinery used consists of three boilers, one 18-h.p. and two 24-h.p., a contractor's double drum hoisting engine, 10-inch by 16-inch crusher bucket elevator and screens in four sections. The product for crushed stone ranges from three-inch to dust. Stone for pulp mills is sorted out in the quarry, the size being about eight inches. Drilling for deep holes is done by means of a well drill driven by a gasoline engine. Steam-driven jack hammers are used for short holes. When inspected in November, 1920 the quarry was being worked in a face varying from 28 to 34 feet. An average of 22 men was employed during 1920.

David Walker, Thorold, Ontario, was manager.

Uhthoff.—The large quarry owned by the Ontario Stone Corporation, Limited, and situated at Uhthoff station on the C.P.R. was worked during the summer by Andrew Peterson and associates under contract. A 20-foot face was worked.

At the more westerly crushing plant at this quarry a jaw crusher was replaced by a No. 6 McCully gyratory crusher; this is driven by a 50-h.p. motor.

Vinemount.—The Wentworth Quarry Company, Limited, worked its quarry on lot 4, concession V, Saltfleet township, with a force of from 15 to 20 men. The quarry is about a mile southeast of Vinemount station on the T. H. and B railway. A 16-foot face is being carried in this pit. Fred W. Schwendiman, Vinemount, Ont., is manager and M. W. Schwendiman, foreman.

Wentworth Quarry.—The Wentworth Quarry Company, at Vinemount, operated from June 1 to the end of the year. The quarry has a face of 16 feet of limestone and the drilling is done by a well drill driven by a gasoline engine. The rock is loaded into cars by a Model 61 Marion steam shovel, and a new Model 28 revolving shovel has been purchased for stripping. The crusher plant of 500-ton capacity is run by a 115-h.p. engine supplied with power from a gas producer. The product is graded from rock sand to 2-inch and is supplied for concrete and road building. The company produced 48,500 tons during the year and employed 16 men.

The officers are: S. Schwendeman, president and manager, and JamesThompson, secretary-treasurer, Vinemount.

Brick Plants

Bartonville Pressed Brick Company.—The Bartonville Pressed Brick Company operated from March 1 to November 15, 1920. The pit has a face of 25 feet of red shale and the plant a capacity of 20,000 bricks per day. Four men were employed.

J. T. Schelter is president and E. Eden, superintendent.

Boyd Pressed Brick Company.—The Boyd Brick Plant near Milton was operated from January to October 1920. The plant has a capacity of 20,000 bricks per day and produced about three million red pressed bricks during the year. The face of the pit is 20 feet. The material is loaded into carts and drawn to the plant.

The officers of the company were: Alex. Graham Boyd, president; Robert Boyd, manager and treasurer; Charles Fessler, secretary.

The plant has been purchased by the Interprovincial Brick Company and will be operated as the Altas Brick Company, Limited.

Canadian Pressed Brick Company.—The Canadian Pressed Brick Company, at Bartonville, worked from April 1 to December 15, 1920. The pit has a face of 40 feet and about 3,2000,000 bricks were made during the year.

Messrs. Lewis and Swinger, barristers, Hamilton, are president and secretary-treasurer. D. New is manager.

Don Valley Brick Works.—The plant in the Don valley, Toronto, operated during most of the year with a capacity of 150,000 bricks per day. They produce buff and red pressed, wire-cut and stock brick, and a small amount of partition tile. The total face is about 200 feet and is worked as four separate pits. The highest layer consists of 25 feet of buff clay and the second layer has a face of 65 feet of Erie clay; the third layer is sand, only part of which is used in brick making; the lowest layer is Hudson shale and has a face of 65 feet.

J. N. Bowman is manager and William Burgess superintendent.

Frid Brothers.—The brick plant and sand and gravel pit belonging to Frid Brothers, at Macklin Street and Dundas Road, Hamilton, was worked from May 15 to October 15, 1920. The pit consists of a layer of clay about 3 feet deep underlying which is sand and gravel. The clay is used in making red and white common stock brick. The brick plant has a capacity of 16,000 bricks per day and during the year produced 1,930,000 bricks. The sand and gravel are loaded into carts by hand.

Arthur Frid is manager and employed seven men.

Hamilton Pressed Brick Company.—The brick plant at the head of Kensington Avenue, Hamilton, was operated from April 1 to December 15, 1920. The plant has ten kilns with a daily capacity of 22,000 bricks. The pit is of red shale and has a face of 70 feet.

Robert New is president and manager and J. Elderkin superintendent.

Hepworth Silica Pressed Brick Company, Limited.—The Hepworth Silica Pressed Brick Company, Limited, operated its plant at Hepworth, Ont., from May to September, 1920, producing 1,500,000 silica pressed (sand-lime) bricks.

Sand (54 to 58% SiO_2) is taken from pits near the brick works and carried to the plant in small cars.

The equipment of the brick plant consists of 2 return tubular 75-h.p. Inglis boilers, a Corliss engine, 16 inches by 36 inches, one steam tight hydrating cylinder 80 feet by 6 feet, two steam tight hardening cylinders, 80 feet by 6 feet, two upright "King Bee" Berg presses, capacity 20,000 each per day and one sand drier (Dutch oven type; belt driven and revolving).

Red, white and buff coloured bricks are produced. The capacity of the plant is 40,000 per day.

The officers of the company are: president, Jas. Douglas, Hepworth, Ont.; vice-president, M. Forhan, Owen Sound, Ont.; secretary-treasurer and manager, P. H. Forhan, Hepworth, Ont.; directors, J. E. Campbell, W. M. Breeze, Chatsworth, Ont., L. Block, Owen Sound, Ont., J. H. Messener, New Hamburg, Ont.-P. S. Patterson, Toronto, Ont.

Milton Pressed Brick Company.—The plant at Milton worked continuously throughout the year 1920. The pit has a face of 60 feet of red shale and is worked in benches. The clay is loaded into cars by two steam shovels with buckets of $^{3}/_{4}$ and $^{7}/_{8}$-yards capacity. The plant has a capacity of 20,000 bricks per day and the different grades of pressed and wire cut brick are manufactured. Thirty men were employed.

The plant at Streetsville has a capacity of 40,000 bricks per day and manufactures wire cut red brick. The face of the pit is 43 feet of hard red shale. It is drilled to the full depth, blasted and loaded by a $^{1}/_{2}$-yard shovel into cars which are hauled up an incline to the plant.

The officers are: president, J. D. McCannell; vice-president and manager, F. R. McCannell; secretary, A. W. Holmstead; general superintendent, C. E. Hill.

Port Credit Brick Company.—The brick plant at Port Credit worked from January, to August 1920. The pit has a face of 40 feet and is operated by one Marion Model 60 shovel with a 2-yard bucket. The product consists of wire cut and red pressed bricks.

M. J. Haney is president and J. F. M. Stewart manager.

Red Star Brick Company.—The brick plant of this company at Stratford was operated for about seven months during the year and manufactured 550,000 red clay bricks. The face is 3 feet and the clay is hauled to the plant in carts.

W. H. Barnhardt is manager.

Shale Brick Company of Canada, Limited.—The brick plant of Cooksville operated from the first of the year to December 1, 1920. The pit has a face of 9 feet of clay and 3 feet of shale beneath. A Marion steam shovel with a 3-yard bucket loads the material into cars which are drawn to the plant by a dinky engine. The plant has a capacity of about 150,000 bricks per day and a total of about twenty million was manufactured during the year. Eight men were employed in the pit.

A. N. Cote is manager.

Standard Brick Company, Limited.—The plant of the Standard Brick Company, Limited, on Greenwood Avenue, Toronto, produced about 5 million bricks during the year. The pit has a face of about 50 feet of blue clay and the plant a daily capacity of 28,000 bricks.

W. Hayes, 352 Greenwood Avenue, is manager.

Streetsville Brick Company, Limited.—The brick plant at Streetsville operated from March to August 31, 1920, and produced about two million bricks. The plant has a capacity of 20,000 red pressed brick per day and the pit has a face of 27 feet of red shale.

F. Longwell is manager and secretary-treasurer.

William Theaker.—The plant for the manufacture of cement blocks, on Kenilworth Avenue, Bartonville, was operated for nine months during 1920 and has a capacity of 100 cement blocks per hour. The gravel is taken from a pit on the property and sand is purchased from the Brantford Sand and Gravel Company.

William Theaker is owner and manager and employed seven men.

Toronto Brick Company, Limited.—The plant located at Swansea worked throughout the year 1920 manufacturing white sand and lime bricks. The sand is taken from the pit at the plant and the lime is received from the lime works at Coboconk. The pit has a face of 50 feet and the material is loaded into cars by a Thew steam shovel and hauled to the plant by an electric locomotive. The capacity of the plant is about 40,000 bricks per day.

J. D. Smith, Swansea, is superintendent.

The company has a plant at East Toronto which was operated during the greater part of the year and has a capacity of 48,000 bricks per day. The pit has a face of 20 feet. The material is loaded by an electric shovel with 1½-yard bucket into tram cars and hauled to the plant by an electric locomotive. Three men were employed.

J. K. Fordyce is superintendent.

A. H. Wagstaff.—The plant of A. H. Wagstaff was operated during the greater part of the year 1920, the production being about 6,000,000 red bricks.

The pt has a face of about 45 feet of blue clay and the plant a capacity of about 30,000 bricks per day.

A. H. Wagstaff is owner and manager.

York Sandstone Brick Company.—The brick plant at East Toronto worked from the beginning of the year to December, 1920. The sand pit has a face of 25 feet and the sand is carried a distance of 500 feet to the plant by a belt conveyor. The lime is obtained from the Canadian Lime Company at Coboconk. The plant has a capacity of 46,000 bricks per day, and had a total production of 10,690,000 bricks. Two men are employed at the pit.

T. J. Smith is manager and W. A. Smith, East Toronto, is secretary-treasurer.

Sand and Gravel

Armstrong Supply Company.—The Armstrong Supply Company operated a gravel pit and washing plant at Burlington Heights during 1920. The pit has a face of 60 feet and the material is loaded into cars by a 15-ton shovel. The cars are hauled by a gasoline locomotive to the foot of the incline and then hoisted to the plant, where the sand and gravel are washed and screened. The different grades are deposited in bins from which trucks are loaded. The total production during the year was 30,132 yards of gravel and nine men were employed.

The officers are: president, Charles Armstrong; manager, C. K. Armstrong; secretary-treasurer, Z. M. Armstrong, 326 Lister Building, Hamilton.

Barton Sand and Gravel Company.—The washing plant of the Barton Sand and Gravel Company, at Bartonville, was not operated during the year owing to failure to obtain water for the plant. Sand and gravel were drawn from the pit by teams for building purposes only.

Bennet.—Joseph Bennet's sand and gravel pit at Scarlet Road and East Drive, near Weston, was operated during 1920.

One bucket loader and one screen are driven by motors; the material is loaded into trucks. The face of the pit is 13 feet.

Joseph Bennet is manager and owner.

Benson and Patterson.—The sand and gravel pits at Stamford worked continuously during the year and shipped 21,000 yards of moulding sand and 10,000 yards of building sand.

The pit has a face of 60 feet with three layers of material: gravel, building sand and moulding sand. The layers of sand are such that the different grades can be obtained without screening.

The moulding and core sands are shipped in four grades; the building sand is shipped as required for brick, concrete, plaster, cement blocks, cement tile, and asphalt.

A pit was opened up during the year for moulding sand only.

Two shovels, each driven by a 40-h.p. electric motor, are used to load the material directly into cars.

F. S. Benson and Robert Patterson are owners and managers.

Constructing and Paving Company.—The sand and gravel pit near Erin was operated from May 1 to November 30, 1920. The pit has a face of 17 feet and material is loaded into cars by a steam shovel and hauled to the plant in dump cars. The rock passes through the crusher and is elevated to the screens and graded to two-inch stone, pea gravel, and sand, of which 157 cars were shipped during the year.

James Pearson is president and treasurer and A. A. Ridler superintendent.

Durham.—The John E. Russel Company of Toronto operated a gravel pit on the property of the National Portland Cement Company, Durham, for six months during 1920.

In the pit a Marion "A" 30-ton steam-shovel is used to dig the gravel, which is loaded into dump cars, and hoisted up an incline to the cement plant.

In arranging a crushing and washing plant, a part of the National Portland Cement Company's machinery has been used. The gravel is dumped into a No.5 Gates crusher, (driven by a 50-h.p. motor, 550 volts) from which it is taken by a bucket elevator (10-h.p. motor, 550 volts to a 40 inch Austin rotating screen (20-h.p. motor, 550 volts), which makes the following products: sand, ¾ inch, 1-inch and 2-inch sizes, which are passed to storage piles under which a belt conveyor (10-h.p. motor, 550 volts) passes in a tunnel so that the sized material can be conveyed to railway cars for shipment. The capacity of the plant was 400 tons a day.

Ten men were employed under Harvey W. Wilson, Durham, Ont., as superintendent. The head office of the company is at Harbour Building, Toronto, Ont.

Forbear Sand and Gravel.—The sand pit of the Forbear Sand and Gravel Company, at Maple, was worked throughout the year and produced about 60 cars per month. The face of the pit averages 35 feet in height and the sand is loaded into cars by a Whirley McNyler one-yard clam-shell bucket. The cars are hauled by a steam locomotive to a trestle and dumped into railway cars. Seven men were employed.

Thomas E. Forbear is owner and manager.

Hamilton Sand and Gravel Company.—The Hamilton Sand and Gravel Company, at Burlington Heights, operated throughout the year. The pit with a face of 40 feet and material is loaded by an electrically driven shovel with a 1-yard

bucket into cars and hauled up the incline to the crushing plant. The gravel is crushed, washed, screened to two grades of sand and three grades of gravel and loaded into trucks from bins. The plant has a capacity of 200 yards per day.

The officers are: president and secretary-treasurer, Wm. Kerr; E. S. Kerr, manager.

Maple Sand and Gravel.—The sand pit at Maple was worked for about eleven months in 1920. The face of the pit is 100 feet and the sand is loaded into cars by a 15-ton locomotive crane with a 1½-yard bucket and a stationary crane with a ½-yard bucket. Twelve thousand cars of screened sand, gravel and pit run were shipped. A small amount of 4-inch, 6-inch and culvert tile was also manufactured by the Maple Sand, Gravel and Brick Company, Limited.

Thomas Cousins is manager.

Rocsand—The sand and gravel pit of the Rocsand Company, Limited, at Erin, was operated from June 15 to November 15, 1920. The plant consists of one steam shovel with a 1½-yard bucket, two crushers and screens. The material is hauled up the incline by hoist to the grizzly and after passing through crushers and screens is elevated to bins or carried to the stock pile by a belt conveyor. The product is shipped in three grades, 1-inch, ¾-inch and sand.

H. N. Kittson, is president and W. S. Connolly vice-president and secretary-treasurer, Hamilton.

Smythe.—The sand and gravel pit at Scarlet Road and East Drive was leased and operated by C. Smythe from May 1 to the end of the year 1920. The pit has a face of 13 feet. The material is raised by a bucket elevator to the screen and bins, the trucks being loaded from the bins.

C. Smythe, 345 Runnymede Rd., Toronto, is manager.

L. Taylor.—Sand and gravel for building purposes were sold by L. Taylor, at Bartonville. The pit has a face of 12 feet and material is drawn by teams.

L. Taylor is owner.

Viney Pit.—The Windsor Sand and Gravel Company, Limited, operated its gravel pit along the Pere Marquette railway, 1½ miles west of Leamington, from April 1st to December 1st, 1920, producing 75,000 cubic yards of material. This pit has been in operation eight years and has a working face of 50 feet. Twelve men were employed under E. McKenzie, Leamington, Ontario, as superintendent.

The officers of the company are: president, A. Leslie, Kingsville, Ontario; vice-president, W. Willis, Walkerville, Ontario; secretary, Hugh McDowell, Windsor, Ontario.

VI.—Smelting and Refining Works

Blast Furnaces

Algoma Steel Corporaton.—The Algoma Steel Corporation is a subsidiary company of the Lake Superior Corporation. The officers are: president, W. C. Franz; vice-president, James Hawson; assistant general superintednent, Joseph W. Wilson; chief engineer, F. Smallwood; works engineer, C. H. Speer; superintendent blast furnaces, James H. Bell; superintendent open hearths, A. H. Hugill; superintendent bloom and rail mill, O. Davies; superintendent merchant mill, James Lycett; superintendent coke plant, Wm. Seymour; mechanical superin-

tendent, Carl Stenbol. David Kyle, the general manager, died in April, 1920, and was succeeded by J. D. Jones who has been general superintendent. Charles E. Duncan who began work with the Algoma Steel Corporation in 1909 and was general superintendent until 1915, returned to the corporation's service in April, 1920, in the same capacity; on February 26, 1921, Mr. Duncan died and his position has not yet been filled. The secretary of the corporation is Alex. Taylor, Traders Bank Building, Toronto; the secretary of the Mines Department is George S. Cowie, Sault Ste. Marie, Ont.

The four blast furnaces ran as follows in 1920: No. 1, all year; No. 2, until December 12, when it was banked; No. 3, until June 14 and again from July 3 to December 21, when it was banked; No. 4, from April 14 to December 23, when it was banked.

A new double-strand Uhling casting machine was put in commission in March; it has effected a considerable saving in labour.

At the end of the year the force in the blast furnace department consisted of but 90 men. James H. Bell is blast furnace superintendent; James Dale assistant blast furnace superintendent; and Harry Hitchens blast furnace master mechanic.

Canadian Furnace Company, Limited.—The furnace at Port Colborne was in operation throughout the year 1920 except for a period of six weeks when the furnace was being relined.

The product was 92,375 tons of malleable and wrought iron from ores imported from the Lake Superior region.

During the year the new first aid building was completely equipped.

An average of 160 men was employed.

The officers of the company are: Frank B. Baird, president; B. Marron, manager; F. E. Deschenes, superintendent; G. J. Higgin, mechanical superintendent.

Steel Company of Canada.—During the year 1920 "B" furnace was operated continuously and "A" was closed down for seven months owing to the shortage of coal, during which time the furnace was relined.

The new pig casting machine was put into operation during the year. The metal is drawn from the furnace into ladles and hauled to the plant by locomotives and poured into moulds on an inclined elevator. The moulds are cooled by water spray while leaving the elevated and then dumped on a conveyor which carries them to the cars or stock piles.

The total production of the foundry, malleable and basic iron for the year was 166,000 tons with an average force of 160 men.

The officers are: Robert T. Hobson, president; R. G. Wells, works manager H. H. Champ, secretary-treasurer; H. G. Hilton, blast furnace superintendent, all of Hamilton.

Refineries

Coniagas Reduction.—The Coniagas Reduction Company, Limited, operated its refinery at Thorold during the year on ores from the mines at Cobalt. The products were: silver, white arsenic, metallic cobalt, metallic nickel, cobalt oxide and copper sulphate. The production of silver for the year was 994,190 ounces and of copper sulphate 221,920 pounds. An average of 100 men was employed.

The officers of the company are: R. W. Leonard, president; J. J. Mackan, secretary-treasurer; D. A. Mutch, superintendent.

Deloro Smelter.—The Deloro Smelting and Refining Company, Limited, operated throughout 1920, treating about 550 tons of ore, concentrates and residues per month at its plant at Deloro, Hastings county. From 250 to 275 men were employed.

The plant now includes departments for the production of: silver and arsenic, cobalt and nickel oxide; alloys: stellite and festel metal, cobalt and nickel; insecticides: paris green, arsenate of lead and arsenate of lime; cutlery: festel and stellite metal, forged and finished for table knives; cobalt salts,—this department was added during 1920, and now turns out cobalt carbonate, sulphate and acetate.

The officers are: president, M. J. O'Brien, Renfrew, Ont.; vice-president, J. Ambrose O'Brien, Ottawa; managing director, Thos. Southworth, Ottawa; general manager, S. B. Wright, Deloro, Ont.; consulting metallurgist, S. F. Kirkpatrick, Ottawa; general superintendent, R. A. Elliott, Deloro; secretary-treasurer, F. A. Bapty, Deloro.

Insecticide plant, Deloro Smelting and Refining Co.—The buildings from left to right are, hydro-electric sub-station, process building, packing and storage building.

International Nickel Company of Canada.—At the Port Colborne refinery of this company operations were carried on throughout the year, but on a reduced scale. For part of the year the total output of matte from the Copper Cliff furnaces was shipped to this plant. There were not any important changes in equipment or practice during the year.

John Moore is general manager and J. T. Kemp, assistant manager. An average of 453 men were employed during the year.

Ontario Smelters and Refiners, Limited.—This company, formerly the Standard Smelters and Refiners, Limited, Chippawa, Ontario, took over the plant of the Metals Chemical Company, Limited, at Welland on April 12, 1920.

After remodelling the plant the new company commenced operations early in July and worked continuously to the end of the year, producing nickel sulphate, cobalt hydrate, cobalt oxide and nickel oxide, all of which were obtained from retreating residues.

Thirty-five men were employed.

The officers of the company are: president, Chas. E. Potter, 1505 Royal Bank Building, Toronto; vice-president, A. Herbold, Chippawa; secretary-treasurer, P. W. Dunbar, Toronto; directors, H. Edward, Montreal; Melvin Jenkins, Buffalo, N.Y.; general manager, J. F. Hickling, Welland.

INSTRUCTION CLASSES FOR PROSPECTORS

By W. L. Goodwin

Introduction

Having been instructed by the Minister of Mines to organize classes for prospectors in selected centres in Ontario, the writer began on November 22nd, 1920, to make the necessary preparations, including collection and breaking up of minerals and rocks for specimens. In the basement of the Parliament Buildings were found materials which supplied about fifteen mineral species. About twenty were obtained from Queen's University through the courtesy of Professors G. J. McKay and E. L. Bruce. A few species were collected in the field and the remainder, making a set of 48 minerals and four rocks, were bought from Ward's Natural Science Establishment, Rochester, N.Y. The work of breaking up this material was so far advanced early in December that it was found possible to begin at Madoc on December 7th. After closing the class there, on December 21st, the preparation of the outfit was continued and completed by January 8th.

Methods Adopted

Classes were held in twelve places:—Madoc, Sault Ste. Marie, Port Arthur, Fort William, Sudbury, Haileybury, Swastika, Kirkland Lake, South Porcupine, Timmins, Elk Lake, and North Bay, covering the time from December 7th, 1920 to June 2nd, 1921. In each place the work consisted of two parts: a class for the determination of minerals by field tests, and a course of eight lectures on the Elements of Geology. The study of minerals was necessarily confined to daylight hours, but the lectures on geology were given in the evening. For the study of minerals, the material was distributed in small pieces to each member of the class. After determination, the occurrence, value, uses, etc., were discussed, and then printed descriptive labels were distributed, in which the specimen could be wrapped and kept for future reference. In this way it was found possible to study forty-eight minerals and several rocks, in the ten days allotted to each place. In addition to some four or five typical rocks, which were used in all the places, I found it possible, particularly in the northern gold fields, to do useful work with the rocks peculiar to the neighbourhood. The day class in each place had nine or ten sessions of about an hour and a half each.

The evening lectures were developed into a logical course on the Elements of Geology, illustrated by lantern slides, the object being to lay the foundation for more systematic study and the better understanding of reports as they are issued by the Geological Survey of Canada and the Ontario Department of Mines. These are quite generally studied by prospectors and there were frequent expressions of the helpfulness of the lectures in this connection. Eight lectures were given in each place, with the exception of North Bay, where it was thought advisable to shorten the time for both classes. It is to be noted that the evening lectures were attended by many who were not free to leave their work during the day, and by others who had a purely intellectual interest in the subject. It was felt that something was being done in this way to stimulate a more general and intelligent interest in mineral industries. To this end the lectures were always used, when possible, as a means of conveying information about the ore deposits of Ontario.

Attendance at Classes

The minerals classes were attended not only by prospectors but by others interested in mineral industries. Some of these will become prospectors. In order to enlarge the horizon of the prospectors, a good deal of attention was paid to minerals that are not being particularly looked for. For example, samples of tin-stone were distributed everywhere, and, as soon as the material could be obtained, tin-stone in the peculiar granite in which it is usually found was shown, and large specimens left in each locality, either in the Mining Recorder's office, or in some other place agreed upon.

A good deal of work was done in the indentification of minerals brought in by members of the classes. For this purpose a blowpipe set was added to the outfit. The meetings of the classes were always prolonged by work of this kind, and by consultation with the prospectors and others looking for information and advice. Where the numbers were large this made a long and busy day.

In the following tabular statement "Registration" refers to the total number attending the class for the study of minerals. Under "Average Attendance" are given numbers obtained by actual count in the case of the minerals class, and by as close an estimate as possible for the evening lectures on geology. In each place there were prospectors and others who were unable to attend the day class. Others were in the field, but had friends or partners attending the class. For such cases sets of the samples were made up when asked for. A record was kept and the numbers are given in the column "Extra Sets of Minerals." The sets of those who attended only part time were also made complete. In this way seven hundred and twenty-four complete sets of fifty-five specimens each were distributed.

Place	Date	Registration	Average Attendance		
			Minerals	Geology	Extra sets of Minerals
Madoc	Dec. 7—21	60	36	29	5
Sault Ste. Marie	Jan. 11—22	110	81	81	20
Port Arthur	Jan. 25—Feb. 4	30	23	34	15
Fort William	Feb. 7—17	38	22	60	20
Sudbury	Feb. 23—Mar. 5	21	14	49	15
Haileybury	Mar. 8—18	47	32	76	20
Swastika	Mar. 21—31	26	16	70	13
Kirkland Lake	Apr. 4—14	28	18	89	25
South Porcupine	Apr. 18—28	44	24	56	25
Timmins	Apr. 30—May 11	60	35	74	20
Elk Lake	May 14—25	30	15	73	16
North Bay	May 27—June 2	15	6	17	21
Totals		509	332	708	215

The low average attendance at the day class is to be explained by the fact that many of the prospectors did not join the class until a day or two after it was started. In some cases, too, members of the class had to break off before the end, owing to change of shift, having assessment work to do, and other causes. In some cases the news did not reach them until the class was well along. In nearly all places the class grew almost to the end. The local newspapers gave effective help by editorial notices and reports of progress as the classes went on.

Madoc

By arrangement with Reeve Burns the classes were held in the village hall. In addition to the local prospectors the classes were attended by several who came from considerable distances—one from Bancroft. By request an extra class was carried on for the Model School teachers and older students. While this extension of the work was not sought, it was not refused in any place where asked for. It will increase the interest in the study of minerals, and may help to keep up the supply of prospectors. Mr. Geo. H. Gillespie, and Mr. A. H. Watson of the *North Hastings Review*, were of great assistance in organizing the class. I wish also to thank Rev. T. H. H. Hall, and Messrs. Chris. Henderson, Donald Henderson, Wm. Cross, C. W. Wallbridge, George Lee, and Karl Stokloser for assistance in collecting minerals. The locality is particularly rich in minerals, and there are a number of keen prospectors at work there. Pyrolusite and bog manganese were brought in by members of the class and identified. Manganese ores in economic quantities are a possibility there. Through the kindness of Mr. Geo. H. Gillespie of G. H. Gillespie & Co., a large supply of talc was obtained. Mr. Robert Bryden, Manager of Canadian Industrial Minerals, sent me a box of selected fluorspar.

Sault Ste. Marie

The minerals class was held in the Board of Trade rooms, and I wish to thank the Secretary, Mr. W. E. Wolfe, for his hearty co-operation and assistance in organizing the classes. Mr. W. N. Miller, Mining Recorder, and Principal Rudlen of the High School were also very helpful. Mr. T. Taylor was engaged as assistant and his services were a considerable factor in making the work go smoothly and satisfactorily. Owing to the unexpectedly large numbers, it was found necessary to divide the day class, one section meeting at 10 a.m., and another at 2 p.m. By request a small class of graduates and advanced students of the High School was formed and I met them at 3.45 p.m. Each class was carried on for about an hour and a half. The evening lectures were held in the Carnegie Library. The very large attendance in the classes for identification of minerals introduced rather serious difficulties both in finding time for the long day's work and in eking out the supply of mineral specimens. The interest in prospecting had been stimulated by the discovery of gold near Goudreau lake, and the temporary closing down of the Algoma Steel works set free a number of prospectors working there for a grubstake, as well as many others who had made up their minds to go in for prospecting. The prospectors consulted me about a field class for the summer, asking if I or some other person could be sent by the Department of Mines to instruct such a class. I suggested that they should organize, draw up a petition, and forward it to the Minister. Forty members of the class expressed their intention of joining such a class, if it were organized. On invitation of the Rotary Club I addressed the members on the relation of the prospector to mineral industries. The Carnegie Librarian, Miss Carlyle, consulted me about books suitable for consultation and study by prospectors. Later I sent her lists supplied by W. G. Miller, and W. M. Goodwin.

Port Arthur

The city council provided quarters for the minerals class in the Ruttan building, and for the evening lectures in the council chamber, Whelan building. I engaged Mr. H. Watts as assistant. Mayor Matthews, Col. S. W. Ray, Col. Francis, J. W. Morgan (Mining Recorder), B. M. Wylie (Crown Timber Agent), and J. E.

Marks gave aid and counsel in carrying on the class. I have to thank Mr. Marks for the loan of a valuable series of photographs taken in the interior of the Labrador country. Slides were made from these and used as effective illustrations in the geology lectures. Mr. F. Rodda, engineer of the Atikokan Iron Company, brought in a quantity of magnetite for use in the mineral classes, and F. Hille gave me samples of siderite and other iron ores for identification. A number of the prospectors brought in samples of molybdenite for identification. Mrs. A. S. Wink, Public Librarian of Port Arthur, wrote asking for a list of books suitable for prospectors. I sent her a list selected from those supplied by Dr. Miller and Capt. Goodwin. At the close of the classes prospectors and other citizens entertained me at lunch and invited me to speak on prospecting in relation to our mineral industries.

Fort William

Here the Board of Education provided a room for the minerals class in the Collegiate Institute and a lecture room in the fine new Technical School building adjoining. Principal E. E. Wood welcomed the classes very cordially and did much to make our work there pleasant and profitable. Mr. R. Cockburn acted as assistant. A number of keen and experienced prospectors make their headquarters in Fort William and Port Arthur. Some of those attending the classes were well acquainted with minerals. Both in Port Arthur and Fort William there is much interest in the development of an Ontario iron and steel industry using Ontario ores. Something might be done with the Atikokan and Mattawin ranges by uniting various interests and operating on a large scale. The Kiwanis Club invited me to an evening meeting to address them on our mineral industries. In connection with our iron ore resources, I ventured the opinion that we should develop processes and practice suitable to our own ores, rather than attempt to make our ores fit the established practice. Through the kindness of Dr. Oliver, Public Health Officer, I made an inspection of the Public Library, a fine building, which is used not only as a library, but as a community centre. The Librarian, Miss Black, showed me a large number of books suitable for prospectors. Very few additions are required to make a good consulting library for their purposes.

Sudbury

On the way to Port Arthur, I stopped off at Sudbury and in company with Mr. R. H. Hutchison, Principal of the Mining School there, made an examination of the possible places of meeting for the classes. It was decided that the most suitable places were those offered by the Board of Education, that is, for the day class, a room in the Mining and Technical School building, under construction, and for the evening lectures the assembly room of the High School. It was expected that the new building would be far enough advanced for this arrangement, but as the date for beginning in Sudbury was two weeks earlier than planned, I found that the room was in an unfinished state. However, the architect and contractor saw that it was made comfortable for us, and it turned out well. The building is particularly well lighted with windows, a good feature where minerals are to be examined. A number of prospectors living at Shining Tree did not see the change of date and so missed attending the class. Others had made arrangements which prevented them from coming at the earlier date. I engaged Jas. Cryderman as assistant. Some members of the class came from Copper Cliff, Shining Tree and Coniston. By request I attended a meeting of the Sudbury Branch of the Canadian Institute of Mining and Metallurgy and addressed them on the iron and steel industry. Much interest was taken in the classes by the staff of the High School.

and I wish particularly to thank Mr. R. H. Hutchison of the Mining School for his assistance in organizing the class, and Mr. C. A. Campbell, Mining Recorder, for his willing and efficient help.

Haileybury

On arrival in Haileybury I had the valued assistance of the Mining Recorder, Mr. N. J. McAulay, in making arrangements for the classes. In conference with Mr. W. H. Tuke, Principal of the High School, a laboratory in the High School building was selected as the meeting place for the day class, and the assembly room was allotted to us for the evening lectures. Both were found very convenient and comfortable. Thanks are due Principal Tuke, Mr. James Hill of the Mining Department of the school, and other members of the staff. Here, as in some other places, the prospectors were a little slow in gathering, but finally they fairly crowded the small laboratory, many coming from Cobalt and New Liskeard and one from as far away as St. Thomas. The great majority of the class were experienced prospectors with considerable knowledge of minerals and rocks. In conversation with some of them I found that they had been studying text books like those of LeConte and Kemp. Mr. L. E. Hamilton, a student of the Mining School, assisted in the work of the classes. At the close of the Haileybury classes, it was arranged by correspondence with the deputy Minister of Mines that Mr. Hamilton should act as assistant to the end of the campaign. This arrangement worked out well, and Mr. Hamilton was thoroughly satisfactory.

At the close of the classes a Prospectors' Association was organized with Mr. James Hill of the Mining School as President, Mr. Train as Secretary-Treasurer, and Dr. W. L. Goodwin as Honorary President. At a banquet held a day or two later at which about eighty prospectors and mining men were present, the organization of the Temiskaming Prospectors' Association was completed, and the whole subject of prospecting in relation to mineral industries was thoroughly discussed. This discussion was made more valuable by the presence of a number of mine managers who could give the point of view of the investor. It would doubtless encourage prospecting and lead to more rapid development if there were some better connecting link between the prospector and the investor. Too often the prospector finds himself unable to continue in his chosen calling because he has reached the end of his means and has been unable to make a sale of claims. It is quite likely that further development of some such claims would show valuable results. What seems to be needed is some more systematic provision for development. Some better plan than the present rather haphazard way might be worked out by frank discussion at joint meetings of prospectors' associations with the Mine Managers' Association and similar bodies.

Swastika

This place was chosen on the request of a Prospectors' Association which has its headquarters there. We were met at the station by Mr. H. Geo. Ginn, Mining Recorder, Mr. T. M. Boisvert, President, and Mr. C. Billington, Secretary of the Prospectors' Association. Prospectors and others gathered in the evening in a room over Boisvert's store and I addressed them there. It had been the intention to start the class that afternoon, but as the train was several hours late, that was found impossible. A good start was made next day, the day class over Boisvert's store, and the evening lectures in the Union Church. Thanks are due Mr. T. M. Boisvert for the use of his room, to Messrs. Billington, Boisvert and others for assistance in fitting up the room and moving the apparatus from the station, to the Board of Management of the Union Church for the use of the church, to Rev. Jas.

Lyttle for many kindnesses, including the use of his lantern, to the club of the local school for the use of their lantern, to Mr. T. A. McArthur, Inspector of Recorder's Offices, whose room in Swastika I occupied while there, to Mr. Ginn for the use of his office and for attending to the advertising, and to many friends for their unremitting efforts to make the class a success and our stay a pleasant one. In this place as in others the number of men who have a good knowledge of minerals is noteworthy. This class was remarkable in having as one of its members, Miss Fetterly, an experienced practical prospector. On the evening of the last day in Swastika, we were very pleasantly entertained at a social gathering held in the Union Church.

Kirkland Lake

By arrangement with Mr. John Gillan the day class was held in the Miners' Union Hall, and it proved to be a comfortable and commodious classroom. The evening lectures were given in the Union Church (Rev. Jas. Lyttle, Pastor). To the officials of both Labor Union and Church, I wish to tender my best thanks. The day class here was attended by many experienced prospectors, including Miss Gertrude Oakes. Kirkland Lake is an unusually compact mining camp, which made it possible for the officials of a number of the mines to gather at the evening lectures. This made it very interesting for the lecturer, who wishes to embody in this report his appreciation of the compliment thus paid him and also of their warm hospitality. Mr. R. C. Coffey, Manager of the Lake Shore Mine, helped me collect samples of porphyry and lamprophyre and gave me a large specimen of telluride. This material was used at all the remaining places visited. Mr. Porteous, manager of the Hunton-Kirkland mine, gave me specimens of wolframite which were useful in the other places visited. A significant incident of our stay here was a visit from a Shining Tree prospector who wished to get information about the rocks and minerals characteristic of the Kirkland Lake area. He spent several days with us, and took with him a complete set of the mineral and rock specimens.

South Porcupine

On arrival at South Porcupine we were met by Mr. W. A. Donaghue, Mining Recorder, who had made all arrangements for hotel, place of meeting, etc. The classes were held in the Oddfellows' Hall, which proved quite satisfactory for the purpose. We made a visit to the Dome Mines, where we were pleasantly received by the General Manager, Mr. Depencier, who, with the Superintendent, Mr. Dowsett, showed us over the surface features, mill, etc. I have to thank Mr. C. E. Morgan for assistance in collecting mineral and rocks. We got supplies of greenstone, diabase, ankerite, quartz, porphyry and tourmaline (near Clifton mine). Mr. Offer, manager of the Clifton, gave us a considerable quantity of scheelite which occurs there. In organising the classes I had much assistance from Messrs. Donaghue, W. G. A. Wood (Crown Timber Agent) and Morgan. Here, as in other places, it was noticed that many of the prospectors were acquainted with a considerable range of minerals. Men attended from Dome Mines, Schumacher, and Pottsville. At a Board of Trade banquet held after the classes were closed, I was invited to speak on "Our Mineral Industries."

Timmins

By arrangement with Mayor McInnis and Councillor Longmore, the O.B.U. hall was secured for the day classes, and the Miners' Union hall for the evening lectures. The officials of the Unions gave us their hearty co-operation and assistance in preparing the halls for the work of the classes. The Timmins class was

notable for the large number of active prospectors, some of whom came from considerable distances, two from Hearst. The hour for the day class was set to suit one of the mine shifts, as a considerable number of prospectors were working in the mines. Two prospectors told me of finding a large piece of float which corresponded with tin-stone samples distributed to the class. Afterwards they sent in samples which were tested and found to be tin-stone. By invitation we visited the Porcupine-Crown, Hollinger and McIntyre mines, and have to thank managers Stewart and Ennis, Mr. Webb, Manager of the Hollinger stores, and engineers Bell, Robinson and Longmore for making these visits pleasant and interesting. We collected supplies of quartz-porphyry and feldspar-porphyry. In all the classes held in the gold areas great stress was laid on porphyries by careful examination of specimens by the class, by definitions, and by microphotographs shown in the evening lectures. As porphyries are associated with the ore bodies in all our new gold fields, it was thought important for the prospectors to have clear ideas on that subject.

Elk Lake

The Council had selected as meeting places for the classes the council chambers for the day class and the school house for the evening lectures. Mr. M. R. Morgan, Mining Recorder, helped us make preparations for the classes and was kind enough to allow me the use of his office for writing letters, etc. I have also to thank Col. H. E. McKee, and Messrs. D. J. Giles, McKinley, and A. P. Campbell for assistance in collecting supplies of minerals and rocks from the Beaver, Silver Alliance, and Blight properties. Bornite, malachite, micaceous hematite, diabase, gabbro, and epidote were obtained. Mr. Frank Wescott gave me some pieces of very pure "kidney" hematite from his new discovery in Montrose? township. Many prospectors were noted on their way up the Montreal river to the Matachewan region. Large numbers were also going into Bruce township, and some claims were staked for gold in Midlothian township.

North Bay

Most of the prospectors who formerly made North Bay their headquarters have moved out, probably gone farther north. But it was thought worth while holding a class there as an experiment. While the attendance was small the result, in increasing the interest in exploration for minerals, was encouraging. Special stress was laid on the advisability of prospecting for minerals other than gold and silver, particularly those that might occur in granite and gneiss. By arrangement with Mayor Ferguson, the classes were held in the fine Normal School building, where Principal Casselman and his staff gave us every facility and made us very much at home. I have also to thank Messrs. Barry Shephard, G. Galvin, and C. G. Watson for many kindnesses, and much help.

General

If the many expressions of appreciation are taken as a fair indication of the value of this work, there can be no doubt about the advisability of continuing and elaborating it. The old days of prospecting by pure chance methods are passed. The prospector of to-day studies the geological maps and reports, and uses them intelligently. He is eager to enlarge his acquaintance with mineral species and rock formations, and to improve his methods by making them more scientific. Prospecting is becoming more and more a profession, in which, however, there will always be room for those of various degrees of scientific education. Advance in mineral industries depends primarily upon the prospector. If he stops work, there

is no more progress. This only needs to be stated, and it at once follows that the profession of prospecting should be carefully nurtured, first by providing adequate facilities for education and second by such economic practice as will ensure a fair return to the prospector—a living wage. He invests his time, money and skill as the pioneer adventurer in mineral development.

Suggestions

At the present stage it does not seem possible to use the ordinary systems of education to meet the case of the prospector. In some way he should get the elements of chemistry and physics—just the essential ideas of these subjects, without the elaboration and detail of the ordinary textbook. This would be the foundation for the study of minerals and rocks, and the essentials of geology and ore deposits. All this can be done in winter, when prospecting is mostly held up. By means of summer field classes the prospector could be instructed in field geology, note-keeping and sketching. This should be done by instructors who are field geologists with some experience in prospecting. A great deal can be accomplished even in a few days of such instruction. The prospector needs only a start. He can be trusted to go on by himself. There are certain facilities for self-education which may be usefully provided. In a number of places where classes were held, the public librarian has adopted the idea of a prospectors' corner or section, where books and reports will be found specially interesting to prospectors. This movement should be encouraged so that in every centre where prospectors make their headquarters they may count on finding the right books, maps, etc. In such places mineral and rock collections may be placed. These should be rather different from the ordinary collections—they should be particular and not general—illustrative of the rocks and minerals of the district. Special collections of gossans, stains, and other "signs," and minerals with their associated rocks, should be made, with the minerals they indicate—all so placed and described in large print that the student may be able to readily take in their meaning. Occasional illustrated lectures by members of the Department of Mines staff and others might be given in such places on subjects of current interest, for example on new discoveries of economic importance.

While it seems hardly possible to utilize the ordinary educational facilities, the mining schools in such places as Sudbury and Haileybury might be used in several ways. The collections mentioned could be housed there, the prospectors' classes and lectures might as a matter of course be held in the same place, and the teacher of geology in the mining school might be engaged to instruct field classes in the summer.

This is hardly the place to discuss the immediate return the prospector should get for his work. It is a very difficult subject, but those most interested should address themselves to it. The present conditions are hardly satisfactory. Many of the best prospectors are becoming discouraged. There is a good deal of chance in the business, and some scheme should be devised for carrying over those whose lucky strike is slow in coming.

Investment in prospecting is subject to the same uncertainties as are found in other business. The credit system is used in the latter and as the business goes on a living is taken out of it. The same idea applied to the independent prospector should in some way give him his living and enable him to go on until he made his strike.

In conclusion it is suggested that the places for holding classes should be selected at an early date so that the whole list with dates of beginning may be published in newspapers. This will enable the prospectors to arrange their business so as to reach the selected place in time.

THIRD REPORT OF JOINT PEAT COMMITTEE[1]

By

B. F. Haanel, Secretary

The investigation being conducted by the Peat Committee appointed jointly by the Government of Canada and the Government of Ontario is concerned with the determination of the feasibility of manufacturing peat fuel on a commercial basis in Canada under present conditions.

The Anrep and Moore Machines

Following plans of action decided upon by the two Governments which were based on experience gained from previous operations carried on by the Mines Branch of the Department of Mines of the Federal Government and by private parties, two machines, one known as the Anrep machine, and the other as the Moore machine, were constructed and installed on the peat bog at Alfred, Ont. prior to the beginning of the season of 1920. Both machines were given a thorough mechanical try-out the previous year, and the design of the Committee was to make a commercial demonstration of both plants during the season of 1920. It was found impossible, however, to operate both plants to capacity, and to take advantage of the full working season.

The Anrep system consists of two main elements, the excavating element, which operates as a unit by itself, and the spreading element. The spreading system employed with the Anrep machine, which has always been considered an inseparable and most important part of the Anrep method of manufacturing peat fuel, consists of a square track layout with rounded corners around which cars, operated by a cableway actuated from the power plant situated on the excavator element, deliver the pulped peat to a spreader, which is operated at right angles to the line of travel of the excavating element.

With this system nine men are required to load cars and spread the peat on the field, and, in addition to these very high labour costs, a serious loss of time is also occasioned by the necessity for moving the tracks, an operation which must be performed at stated intervals to keep march with the forward motion of the excavating element. In the operations during the season the capacity of this plant was also reduced owing to the difficulty encountered of delivering a continuous supply of cars to the spreader.

The principal innovations in the Moore system are, the unique device employed for delivering the pulped peat to the spreader and laying it on the drying field, and the method of excavating the raw peat. The former is accomplished by delivering the pulped peat from the macerator continuously on to a belt conveyor, which is supported on a bridge work some 160 feet long attached to the main peat machine at right angles to its direction of travel. The delivery and spreading of peat is, therefore, continuous and automatic; but unlike the Anrep system the peat is spread parallel to the direction of travel of the excavating element. As a result, the Moore system requires a much greater length of working face than the Anrep system, in order to lay its full season's production on the field; but the number of men required to operate it to full capacity is very much less than in the Anrep system.

Operation of the Plants

Both plants were worked during the entire season, although not continuously, the Anrep plant being operated on that portion of the field which had been pre-

[1] See also First Report Joint Peat Committee, Bur. Min. Rep. Vol. XXVIII, 1919, Pt. 1, pp. 187—192, and Second do, Vol. XXIX, 1920, Pt. 1, pp. 142—156.

pared several years, and which was, consequently in condition for manufacturing peat fuel to the best advantage. The Moore plant, on the other hand, was operated on that portion of the bog lying adjacent to the C.P.R. tracks which had not been drained and was, therefore, inferior to the other portion of the field. This handicapped the Moore machine seriously; but it was the desire of the Peat Committee to give the Anrep unit every possible advantage in order to prove its value, since it was of standard design as regards the principles employed in excavating and spreading, and it was contemplated that the Moore machine would require a great many alterations before it could be put in working order. Notwithstanding the handicaps under which the Moore plant operated, it became manifest early in the operations that this plant would not have to be seriously altered in order to put it in good working shape.

Between 5,000 and 6,000 tons of air-dried machine peat fuel with approximately 25 per cent. moisture were produced during the season of 1920, the greater portion of which was sold to householders in Ottawa, Peterborough and other cities and towns and a certain portion sold for commercial purposes.

Results So Far Obtained

Although it is not yet possible for the Peat Committee to say whether peat fuel can or can not be manufactured on a commercial basis, they can definitely state, as a result of the investigation so far conducted:

1. That the Anrep plant as it stands is in no sense commercial.

2. That the Moore plant under certain conditions can be employed commercially for the manufacture of peat fuel.

3. That the Anrep excavating element is the superior of the two and the logical one to employ, while

4. The Moore spreading system is much more efficient, and is the logical spreading system to employ.

The main difficulty with the Anrep machine is the high cost of labour of the spreading system, and the large amount of time lost on changing tracks and in delivering a continuous supply of peat to the field, resulting in reduced capacity. The main difficulty with the Moore system is the excessively long face working which is required, an inherent difficulty which prevents this type of machine from being employed intensively on the average bog.

Combining Best Features of the Two Methods

In order to manufacture peat fuel on a large commercial scale during the comparatively short working season, it is absolutely essential that the bog be worked intensively, that is to say, that the largest number of units practicable be employed. This can only be accomplished by employing an excavator of the Anrep type combined with a spreading system of the Moore type, and moreover, it is essential that all manufacturing units be driven by electric motors supplied with current generated in a central station, which will effect a further reduction in costs.

On the strength of the results which the Peat Committee have obtained up to the present time, and after very careful consideration of the same, they recommend that the Anrep excavating element, which requires no alterations and is in as perfect condition as it is possible to put it, be combined with the Moore spreading system. This spreading system, in order to meet the requirements of the Anrep excavating machine, will have to be specially designed inasmuch as the bridge work which will operate the belt conveyor will be some 850 feet long. The bridge work carrying the belt conveyor at right angles to the direction of travel of the ex-

cavator will move parallel with the excavator. The belt conveyor will deliver the pulped peat to a spreader which will lay it in 800-foot rows parallel to the bridge work and at right angles to the line of travel of the excavator.

The designs for this new spreading system have already been thoroughly worked out, and are sufficiently complete to be placed in the shop for fabrication. With this new element the Anrep excavator will be permitted to work at full capacity throughout the working hours and deliver pulped peat continuously to the spreader. While no attempt will be made to describe this transportation system in detail, it should be pointed out that the design of this new system required a large amount of work and expert advice, and, in order to reduce the chances of failure to as great a degree as possible, the Peat Committee enlisted the expert opinion of engineers and companies of experience in belt conveying systems used for various purposes.

It is also the intention of the Peat Committee to operate the Moore plant, as it stands, continuously throughout the season of 1921 on a strictly business basis, with the minimum complement of men and without the attention of the expert engineering staff. This plant then will serve, first, as a demonstration plant for those who are desirous of witnessing the manufacture of peat fuel, and second, will also enable exact figures of costs of manufacture, harvesting, etc. to be obtained.

It is imperative that the combined plant above mentioned be erected, mechanically tried out, and commercially demonstrated before the Peat Committee can offer a definite opinion regarding the feasibility of manufacturing peat fuel on a commercial scale in Canada; but it must be understood that even though the equipment is placed on the field early next season, it will be absolutely impossible to do more than operate it to determine weaknesses and changes which may have to be made in the design and to give it a thorough mechanical tryout, at the same time of course manufacturing a small quantity of fuel. The commercial demonstration of the combined plant cannot possibly be made until the following season, and its commercial feasibility may not even be determined at the end of the same, but the Peat Committee have every reason to believe that the operation of the plant during the season of 1922, will afford sufficient data to enable the Peat Committee to decide definitely whether or not peat fuel can be manufactured on a commercial basis at a profit under conditions existing in Canada at the present time.

Small Plant For Local Manufacture

In addition to the above programme of work the Peat Committee have constructed a small peat machine which can be operated by two men and a boy, or say three men, for the purpose of supplying farmers or groups of farmers with a cheap, satisfactory fuel for their own immediate use, or for the use of the inhabitants of villages and small towns. This machine is constructed and partially erected, and its utility for the purpose for which it was designed can be determined without difficulty in a very short time. This part of the work will proceed along with the other.

The problem, therefore, with which the Peat Committee is confronted, and which it hopes will be solved at the conclusion of the season of 1922, resolves itself principally into the design of a machine which will be capable of manufacturing a large quantity of peat fuel during a comparatively short working season, with the minimum employment of manual labor, and at a cost which will permit the fuel so manufactured to compete with coal at existing prices. The present-day conditions which the Peat Committee have to meet are; greatly increased labor costs—twice and in certain cases three times what they were prior to the war—and greatly increased cost of materials and machinery and general plant employed. Costs have mounted to two and three times the figures prevailing prior to the war. These conditions, coupled with unstable labour market and great difficulty in getting

plant fabricated and delivered at the required time, are mainly responsible for the time absorbed in the investigation and have severely handicapped the Peat Committee's efforts.

A Short Working Season Inevitable

It has been appreciated by all investigators who have devoted their time and attention to the manufacture of peat fuel that the development of the peat resources of the world would be greatly enhanced if operations could be conducted throughout the entire year. Numerous costly investigations and experiments have been made both in Europe and on this continent with that end in view. The net result of such operations, however, up to the present time is that although millions of tons of peat fuel are produced annually in Europe, the only process which has proved of economic value for operations on any practical scale is that which depends upon the sun and wind for the removal of the large quantity o excess moisture contained in the raw peat. This process is, therefore, the result of all the efforts which have been made by investigators for a period covering more than a century to utilize peat for fuel purposes.

The Peat Committee is not attempting to alter the process itself, but is rather directing its efforts to the development of more efficient and more economical means of conducting the various operations of which it consists, in order to meet the special conditions as to cost of labour, etc., prevailing in this country.

An Expert on Committee's Work

It may be stated that the direction and scope of the Committee's operations up to the present time have commended themselves favourably to European investigators of wide experience and knowledge of actual conditions prevailing in the industry, and of the successful commercial manufacture of peat fuel in the various countries where its production has been carried on upon any large scale. Prof. Pierce F. Purcell, of Dublin, Ireland, who is conversant with peat operations throughout Europe, and who recently visited Canada as special investigator for the British Fuel Research Board, after careful study of the plant being developed and the methods being used by the Committee at Alfred for the production and harvesting of peat fuel, made the following statement:—

> That the Fuel Research Board were convinced of the value of the work being carried out here is, I think, evident from the fact that they have sent me to Canada specially to report on the work carried on at Alfed. I have now spent some time at Alfred, and I think it is only right that I should say that in my opinion the work carried out there is in advance of any work which to my knowledge has been done elsewhere.

It may be of value here to state that the peat-using countries of Europe are, like Canada, handicapped by a short manufacturing season, yet, in spite of the short season, a very large portion of the fuel requirements of certain of the European countries is supplied by peat fuel. For example 60 per cent. of the fuel requirements of Ireland are supplied by the manufacture of hand cut, air-dried peat fuel; while in Denmark alone the annual production of peat fuel is estimated at over a million tons. Sweden, similarly, produces large quantities of peat fuel, in fact uses peat powder as a fuel on one of her state railways. Before the war Russia manufactured very large quantities of peat fuel, according to some authorities as high as six million tons, and other European countries, notably Holland, Germany and Italy, use peat fuel in industrial plants as well as for domestic purposes. It is therefore reasonable to assume that under similar conditions Canada could manufacture sufficient peat fuel to largely decrease the quantity of coal which it is now necessary to import annually.

Inasmuch as the investigation is in no sense complete and certain essential data have not yet been determined, it is not advisable to state an estimated cost, largely based on assumptions, of manufacturing a ton of peat fuel. The cost of manufacturing peat fuel can, therefore, only be definitely stated at the close of the investigation.

NOTES ON CLAYS OF THE MISSINAIBI RIVER

By Joseph Keele[1]

Introduction

In the summer of 1919 the writer examined the clay and shale deposits exposed along the banks of the Abitibi and Mattagami rivers. The most important result of this exploration was the discovery of fire clays of Lower Cretaceous age on the Mattagami river.[2] Apart from the probable economic value of the fire clays, the fact that rocks of Mezosoic age occur in northern Ontario is of considerable scientific interest as the existence of any such rocks was hitherto unsuspected in this region.

During the summer of 1920 a short journey was made down the Missinaibi river from Mattice, a station on the National Transcontinental railway, but owing to unforeseen circumstances only a part of the proposed examination was accomplished.

The Missinaibi river joins with the Mattagami and Abitibi to form the Moose river which flows into James Bay. It has sunk its bed in the great sheet of glacial drift which overspreads the entire region. A detailed description of this drift sheet is given in Part II of the Ontario Department of Mines report for 1920.

Fig. 1—Round bay, Missinaibi river, looking south from high bank of glacial drift toward the pre-Cambrian escarpment. The Paleozoic plain begins here and reaches to the shores of Hudson Bay.

There are frequent exposures of bedrock, the schist complex of the pre-Cambrian, in the river bed for a distance of 40 miles below Mattice, but below this there is no hard rock exposed.

Pleistocene or Glacial Clays

Boulder clay or till.—A sheet of boulder clay extends over the greater part of the region and conceals the underlying bedrock or any deposits of an earlier date

[1] Ceramic Engineer, Dept. of Mines, Ottawa.

[2] Report Ont. Dept. of Mines, 1920, Vol. 29, Part II, pp. 31-55; Geol. Survey of Can., Summary Report, Part D, 1920.

except at certain points where the river has cut down far enough to reveal them. This material consists of a mixture of a clay and silt, sand, gravel and stones with some very large boulders also embedded in it. One of the most striking features of the Missinaibi river is the quantity of large boulders scattered over its bed which in low water stages impede boat navigation to a considerable extent. These boulders have been released from the till sheet by the river, but are too heavy for it to move down stream. The boulder clay has no special economic value except that a very good soil forms on its surface, and pioneer farming operations have now reached the river banks.

Glacial lake clays.—There are occasional depressions in the boulder clay surface which have become filled with stratified stoneless clays, and these are the kind of clays sought by brick and tile makers; the boulder clay being utterly unsuitable for this purpose. A fairly extensive deposit of the stratified clay occurs on the west bank of the river on John Christianson's ranch. It is from 4 to 15 feet in thickness and is underlain by fluvio-glacial gravels. These gravels were used for the construction of the concrete abutments of the railway bridge across the river at this point.

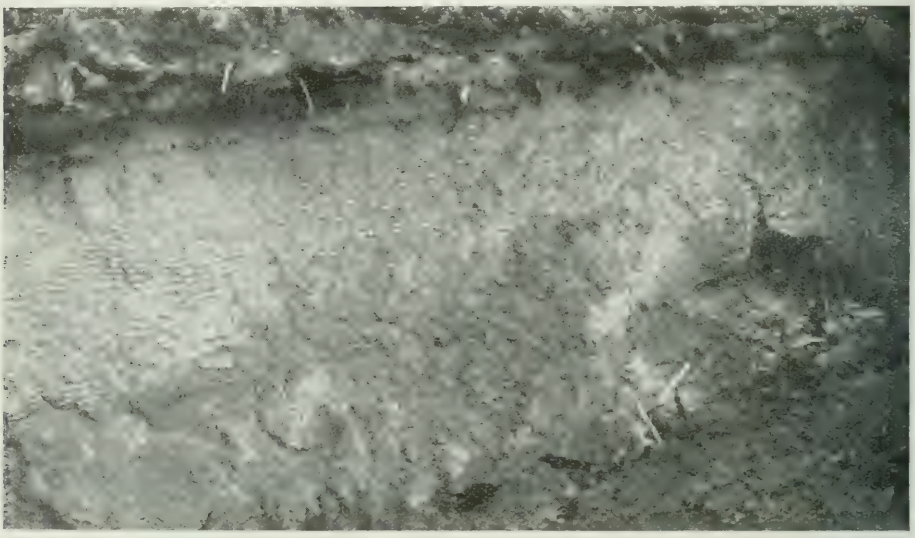


Fig. 2—Stratified clay overlying boulder clay on creek bank ½ mile east of Mattice station, National Transcontinental Railway, Algoma district.

A small creek which crosses the railway about half a mile east of Mattice station has been cut down through a deposit of stratified clay as far as the underlying till, a depth of 8 feet. This deposit (Fig. 2.) consists of alternating layers of ash-colored silt and brown plastic clay. In the middle and lower part of the section there are occasional small pockets of coarse gneissic grit, and individual pebbles are scattered all through the deposit. The underlying till, which forms the bed of the creek, is a compact bluish grey clay containing numerous cobblestones and boulders.

An average sample of the stratified clay was collected for testing. It was found to work up well when wet and was plastic enough to make brick or even tile. It burns to a cream or light buff-coloured body with a total shrinkage of 6 per cent. Like all clays with a high lime content, it has a rather porous burned body but the

strength is sufficient for any kind of structure. Unfortunately, some of the pebbles scattered through the clay are limestone and these are detrimental to burned clay wares. Some of the burned test pieces are spalling on this account. A good deal of this trouble may be avoided, however, by using only the upper 4 feet of the deposit which contains fewer pebbles than the lower portion.

The upper 18 inches of the deposit is weathered, and the greater part of the lime is leached out of this portion. A separate sample of the top clay was found to have very stiff plasticity, a rather high shrinkage and to burn to a dense body of good red colour. This is an altogether different product from that which the bottom clay gives, the difference being due to the effect of weathering. This clay would be suitable for the manufacture of red and buff building brick or for field drain tile, but care should be taken to avoid those parts of the deposit containing pebbles.

Fig. 3—Post-glacial gorge cutting in the pre-Cambrian schist complex, Missinaibi river, Conjuring House chute.

There is not much opportunity for examining the river banks below Mattice as they are generally low and wooded almost to the water edge, but the few outcrops seen were stony clay, and the multitude of boulders that are strewn on the river bed would seem to indicate that the river banks are mostly boulder clay. The frequency of bedrock outcrops and the network of boulders on the river bed have kept the Missinaibi from cutting downward like the Mattagami or Abitibi, whose banks are high and show plenty of drift outcrops, the Missinaibi still practically flowing on the surface of the land. Its activity is apparent, however, when approaching the northern edge of the pre-Cambrian rocks where the post-glacial gorge cutting is proceeding on the same vigorous scale as on the other large rivers of the region (Fig. 3).

North of the pre-Cambrian rock border the river flows in a deep trench cut in the glacial drift and other soft rocks. On Round bay, an expansion of the river 45 miles north of Mattice and about a mile north of the last outcrop of pre-Cambrian rocks, the drift section at one point is made up as follows:

Gravel	2	feet
Stoneless clay and silt	10	"
Boulder clay	30	"
Stratified silt and sand	10	"
Very fine grey sand unstratified	20	"
Concealed	30	"
	100	

Generally speaking the boulder clay predominates along the banks of the river. but generally the boulder clay predominates along the banks of the river.

There were two distinct periods during Pleistocene times in northern Ontario when land ice occupied the whole region. The ice completely withdrew between these periods, and erosion, sedimentation and plant growth went on as they do to-day. The materials laid down after the withdrawal of the first ice sheet and before the advance of the next one are called "interglacial." The last advance of the ice removed or destroyed most of the material accumulated during the interglacial age, but there are still some quite imposing remnants. Only two outcrops of interglacial measures were seen by the writer. One of these was on the east side of the Missinaibi river just below the northern end of the Long portage. It consists of the following materials:

		feet	inches
Boulder clay—Late Glacial		10	0
White and rusty sand	Interglacial	40	0
Laminated peaty clay	Interglacial	1	6

The laminated clay contains a great quantity of biotite particles which gives it a black colour, but some of the layers are lighter in hue. There is an occasional layer of limonite about half an inch in thickness. Toward the bottom of the deposit thin layers of peat are interlaminated between micaceous silts. This clay is much harder than the late glacial stratified clay such as the one described from Mattice, and it resembles shale in some respects. This deposit has no great lateral extent as it lies as a filling in an old valley in the pre-Cambrian bedrock which was probably a pre-glacial river channel. The base of the stratified clay was not exposed. No clay of this description was seen below this point for a distance of 40 miles where a more complete series of interglacial beds outcrop on the east side of the river, about 4 miles above the mouth of the Soweska river. The section here consists of:

Stratified olive plastic clay	2	feet
Compressed peat	3	"
Yellow sand and gravel with lenses of till	12	"
Brown till	6	"
Yellow stratified sand and gravel	9	"
Hard reddish brown till to water edge	6	"

This section is not uniform throughout the deposit, as there are two layers of peat separated by 2 feet of stratified sand and clay in another part of the section, and the peat lies both on till and on gravel. The yellow stratified sand and gravel is replaced by stratified fine-grained olive clays with films of limonite, similar to the clay near Long portage. These materials are overlain by the late glacial till, and this till forms the entire banks above and below the interglacial remnant. These were the only two outcrops of interglacial beds seen by the writer, but there are more extensive deposits of similar materials farther north on the Missinaibi river,

[1] Ont. Bur. Mines Rep., Vol. 13, 1904, Part I.

and also on its tributary streams the Wabiskagami and Soweska, which have been examined by J. M. Bell [1] (Fig. 4). The deposit of interglacial clay at Long portage has never been described before and it is the most southerly occurrence of this kind of clay known in northern Ontario.

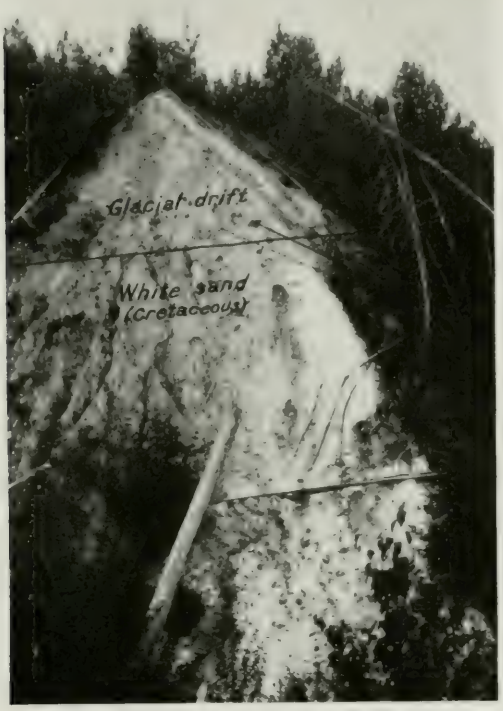


Fig. 4—White Cretaceous sand under boulder clay on Missinaibi river, 4 miles above mouth of its tributary, the Wabiskagami river.

The interglacial clays have no special value in a remote region like this, because they are not high grade materials which would stand transportation charges, such as the Cretaceous clays described below. They are better brick clays, however, than the late glacial clays such as the deposit at Mattice. The best brick clay in southern Ontario is an interglacial clay which occurs in the vicinity of Toronto. It has certain characteristics in common with the interglacial clay on the Missinaibi, so much so that Coleman is of opinion that the two sets of deposits were probably formed at the same period. [1]

[1] Interglacial Periods in Canada—Compte Rendu, Cong., Geol. Intern. Mexico, 1906.

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THIRTIETH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

VOL. XXX, PART II,

1921

Ontario Gold Deposits

Their Character, Distribution and Productiveness

By

PERCY E. HOPKINS

PRINTED BY ORDER OF THE LEGISLATIVE ASSEMBLY OF ONTARIO

TORONTO

Printed and Published by Clarkson W. James, Printer to the King's Most Excellent Majesty

1922

Printed by
THE RYERSON PRESS.

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Their Character, Distribution and Productiveness

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Sample of gold ore (natural size) from between the sixth (550-foot) and seventh (700-foot) levels of the Dome mine, Porcupine.

ONTARIO GOLD DEPOSITS [1]

THEIR CHARACTER, DISTRIBUTION AND PRODUCTIVENESS

By

Percy E. Hopkins

Gold mining at the present time is receiving renewed attention in Ontario. Abundance of labour, reduction in mining costs, and the premium on gold are chief causes of the stimulation. In 1920 the exchange premium received by Ontario's gold mining companies was $1,376,275 or 11.7 per cent. The success or failure of Ontario's gold mining industry, however, is not dependent on the premium, the rate of which is, at this time, declining rapidly.

It is the purpose of this paper to give an historical summary of gold mining in Ontario, and to describe, as succinctly as possible, the geological features of the several gold fields as related to the ore deposits. Notes on the character of the deposits themselves, their production and development will naturally be included. The mining claim numbers, and the important literature of each area have been given.

Accompanying the paper are index maps showing the location of the producing gold mines and of many gold prospects. Railway stations and wagon roads, together with hydro-electric power plants and transmission lines serving the gold mining industry, are also shown. The maps were drawn by H. C. Smith, cartographer of the Ontario Department of Mines. I wish to express my appprecciation to W. R. Rogers, statistician of the Ontario Department of Mines, for his kindness in furnishing statements of gold production. I am also specially indebted to Dr. W. G. Miller, Provincial Geologist, and T. W. Gibson, Deputy Minister of Mines, for numerous suggestions.

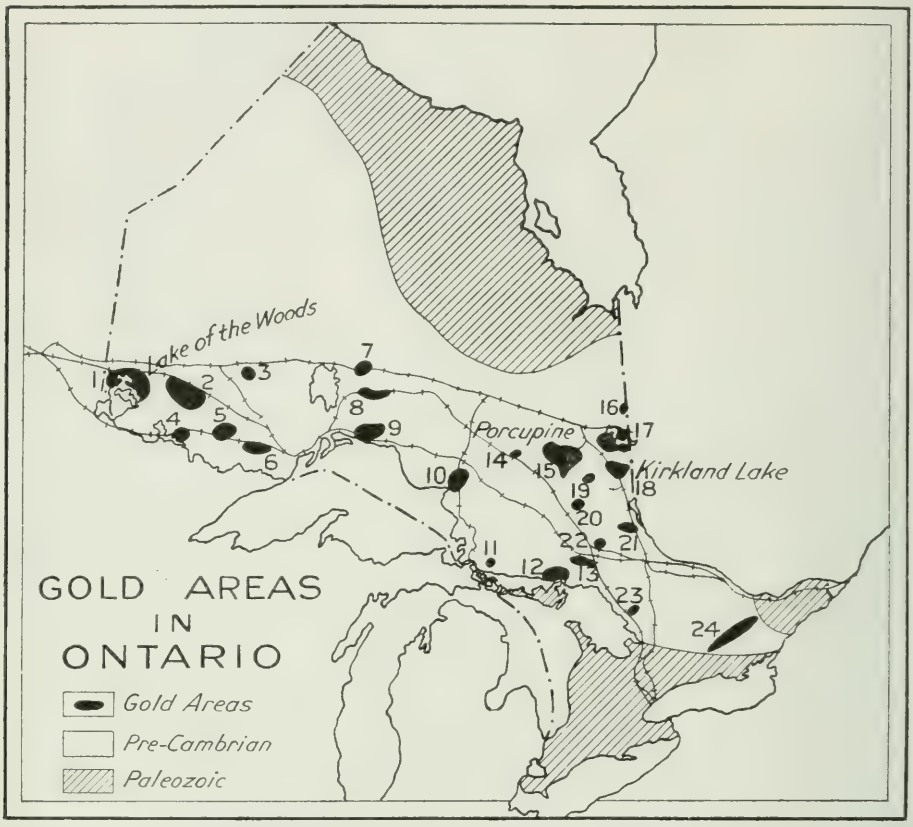
History

Gold was first discovered in Ontario in 1866, at the Richardson location, Hastings county, southeastern Ontario.

Curiously enough, the Richardson deposit was far from being typical of Ontario gold mines, either of the locality in which it was found or elsewhere. The original account of the discovery is given by H. G. Vennor in the report of the Geological Survey of Canada 1866-69, page 165 *et seq.* Mr. Vennor, who in May 1866 began the work of geological exploration in Hastings and adjoining counties which he carried on for several years, had instructions to take "particular note of all mineral deposits of economic value." He states:

> In the early part of August, 1866, while exploring in the neighborhood of Bannockburn village, in the township of Madoc, I was informed that a metal, suspected to be gold, had just been taken from an opening in the eighteenth lot of the fifth range of the township, on the property of Mr. J. Richardson. A visit was at once made to the locality and the lot was found to be the same as that on which openings had previously been made for copper ore, described in Mr. Macfarlane's Report of 1866, (p. 106). Mr. Richardson informed me that a person named Powell, and an old Dutch miner, had lately found flakes of yellow metal resembling copper, which he could beat out into thin leaves. At my request he showed me the specimens which he had collected, and I at once informed him that the metal was gold.

[1] Paper presented in abstract at the annual meeting of the Canadian Institute of Mining and Metallurgy, March, 1922.



MAP OF ONTARIO SHOWING THE LODE GOLD AREAS.

1. Lake of the Woods and West Shoal lake.
2. Eagle Lake, Wabigoon or Dryden, Manitou and Sakoose.
3. Sturgeon lake.
4. Mine Centre, East Shoal lake or Lower Seine area.
5. Atikokan or Upper Seine area.
6. Huronian and Shebandowan lake.
7. Kowkash and Tashota.
8. Jellicoe, Kinghorn and Little Long lake (only a few assays have been obtained from this area).
9. Schreiber, Duck lake and Jackfish.
10. Michipicoten and Goudreau.
11. Ophir or Havilah (Galbraith township).
12. Shakespeare, Howry creek and Whiskey lake.
13. Long lake and Sudbury.
14. Tionaga.
15. Porcupine, Cripple creek, Night Hawk lake and McArthur township.
16. Patten river (only assays obtained here).
17. Painkiller lake, Rickard, Abitibi lake and Lightning river.
18. Kirkland lake, Larder lake, Boston creek, Swastika and Bourkes.
19. Matachewan.
20. West Shiningtree.
21. Timagami.
22. Wanapitei.
23. Parry Sound.
24. Southeastern Ontario (Peterborough to Lanark county).

Mr. Vennor describes the opening from which the gold was taken as being on the east end of the lot, and containing an irregular layer of chlorite and epidotic gneiss, which was overlain by a band resembling an impure steatite, the whole dipping N. 5° E. at an angle of 45°. The seat of the gold appeared to be a crevice of longitudinal ovoid form, about 4 feet below the surface, filled with reddish-brown ferruginous earth, in which were scattered fragments of a black carbonaceous matter, the latter showing when broken, small flakes or scales of the metal. Fresh blasts were made during Mr. Vennor's stay, but no further development of the precious metal resulted. Later, in October, on returning to the mine, Mr. Vennor found that at a depth of 15 feet, another open crevice had been struck, which beyond doubt proved rich in the metal. From the ferruginous carbonaceous earth, Mr. Vennor himself obtained by washing and amalgamation 25 pennyweights of gold. He observed no gold in the solid rock, but shortly afterwards, some "very beautiful and rich" specimens were displayed to him, in which the gold was enclosed in the dolomite and calcspar.

Powell himself, the discoverer, confirms[1] the story of the crevices. He was following on a seam for copper, and at a depth of 15 feet struck ore carrying free gold. The seam was 6 inches wide at the top and was decomposed for 6 feet, then it was solid rock to 15 feet, "when it suddenly opened out into a cave 12 feet long, 6 feet wide and 6 feet high, so that I could stand upright in it." The gold was found in the rocks of the roof, walls and floor, in the form of leaves and nuggets, and in the roof it ran through a foot thickness like knife-blades. The largest nugget was about the size of a butternut. Powell and his associates disposed of their interest in the discovery for $36,000, but there is no record of the amount of gold taken from the deposit. This discovery attracted a large number or prospectors, who over-ran the neighborhood during the summer of 1867, and whose rough and ready ways necessitated the organization of a squad of mounted policemen, 25 in number, in March of that year; they were discharged in September. Gold was found in several of the surrounding townships, but the rich deposit on the Richardson farm was not duplicated.

In the Hastings area gold has been produced spasmodically up to the present from numerous properties, the principal being the Deloro and Cordova.

The first important discovery in northwestern Ontario was made by Peter McKellar in 1871, at what was afterwards known as the Huronian mine, Moss township. In 1872, gold was found on an island in Partridge lake. This was followed by many other discoveries in the Lake of the Woods district where the chief mines were the Sultana, Mikado, and Regina. In 1875 small nuggets of gold were found on Victoria cape, near Jackfish, Lake Superior. The discovery of gold on the United States side of Rainy Lake in 1892 resulted in prospecting soon being extended into Shoal Lake, Seine river, Manitou, Sturgeon lake, and other neighboring areas. The gold boom of northwestern Ontario reached its peak in 1897, resulting in many unwarranted stamp mills being erected. Inefficient management and stock-jobbing operators caused the loss of much capital; nevertheless certain mines—the Sultana, Mikado, and Regina—produced from about one-half to three-quarters of a million dollars each.

Gold associated with copper was found at the McGown property, two miles east of Parry Sound, in 1894, but little production resulted. In 1895 and 1896 the precious metal was discovered on the north shore of Lake Superior, at Jack-

[1] Rep. Ont. Bur. Mines, Vol. III, 1893, p. 54.

fish and Schreiber, respectively, and the area was enlarged in 1914 by the discovery of gold at Duck Lake, 18 miles north of the latter place. From 1892 to the present time, isolated properties, situated near Wanapitei and Sudbury, and westward along the north shore of Lake Huron, have had a small production; these include the Crystal, Ophir, Shakespeare, Long Lake and others. In addition, a small quantity of gold is recovered from the nickel-copper ores at Sudbury. Since 1902, three or four mines have produced in the vicinity of Wawa, Michipicoten, where gold was found in 1897, but they are now lying idle. Of these, the Grace mine is best known. East of Goudreau on the Algoma Central railway gold was found in 1918, and in 1921 the Murphy claims were staked out southwest of that station.

The discovery of silver at Cobalt in 1903 brought hundreds of prospectors into northeastern Ontario. From 1905 to 1918 important gold areas were found annually. They are as follows: Playfair, 1905; Abitibi and Larder Lake, 1906; Night Hawk Lake, 1907; Painkiller, 1908; Munro and Porcupine, 1909; Swastika, 1910; Howry Creek and West Shiningtree, 1911; Whiskey Lake and Kirkland Lake, 1912; Boston Creek, 1914; Kowkash-Tashota, 1915; Matachewan, 1916; Rickard and Lightning River, 1917; Bourkes, 1918. In addition to these areas, many small gold discoveries have been made in other localities.

Porcupine is by far the largest producer, the principal mine, the Hollinger Consolidated being one of the great gold mines of the world. Kirkland Lake area is next in importance. Ontario now leads the other provinces of Canada, and every state in the United States, excepting California, in production. Ontario produced 74 per cent. of Canada's gold production in 1920. There is every reason to believe that Ontario's gold production will continue to increase for some time. Gold is so wide-spread and the production is so substantial and increasing so rapidly, that it seems fitting to name Ontario the "Golden Province."

Production

The total gold production of Ontario up to the end of 1920 was $73,173,463, all of which came from pre-Cambrian deposits. From 1892 to 1911 the total production was small, the greatest output for any year being $424,568 in 1889. During these years the Sultana, Mikado, and Regina were the principal producers. Gold has been recovered as a by-product from the copper-nickel ores mined at Sudbury, where work began in the late eighties. A small recovery of gold has also been made from the Cobalt ores. The Lake of the Woods mines were not active between 1904 and 1911. In 1909, the Laurentian was the only producer.

Up to 1911 gold mining in Ontario was on the whole not profitable. Since then the industry has flourished, owing particularly to Porcupine, and, to a less extent, to Kirkland Lake. The 1913 production, $4,558,518, almost equals the entire output up to that year from the time gold was first found in the Province in 1866. In 1920 the gold production exceeded the silver output for the first time since Cobalt was discovered in 1903. The gold production of Ontario for 1921 will likely amount to about fourteen million dollars. For the first nine months of the year it was valued at $9,818,073. Ontario is the only important country whose gold production has not decreased in the last four years. The world's maximum production of 468.7 million dollars in 1915 has steadily de-

creased to 339.4 million dollars in 1920. The table which follows shows the yearly and total gold production of the Province up to the end of 1921, as published by the Ontario Department of Mines.

GOLD PRODUCTION OF ONTARIO.

Year	Ounces	Value$	Year	Ounces	Value$
1866-1891	9,260*	190,258	1907	3,810	66,399
1892	1,785	36,900	1908	3,465	60,337
1893	1,695	32,960	1909	2,042	32,445
1894	2,022	32,776	1910	3,619	68,498
1895	3,030	50,281	1911	2,062	42,637
1896	7,154	121,848	1912	102,278	2,114,086
1897	11,412	190,244	1913	220,837	4,558,518
1898	16,261	275,078	1914	268,942	5,529,767
1899	27,594	424,568	1915	411,588	8,501,391
1900	18,767	297,861	1916	497,833	10,339,259
1901	14,293	244,443	1917	420,893	8,698,735
1902	13,625	229,828	1918	411,878	8,502,480
1903	10,383	188,036	1919	505,964	10,451,709
1904	2,285	40,000	1920	565,283	11,686,043
1905	5,541	99,885	†1921	707,509	14,624,085
1906	3,926	66,193	Total	4,276,876	$87,797,553

*Estimated

†Preliminary.

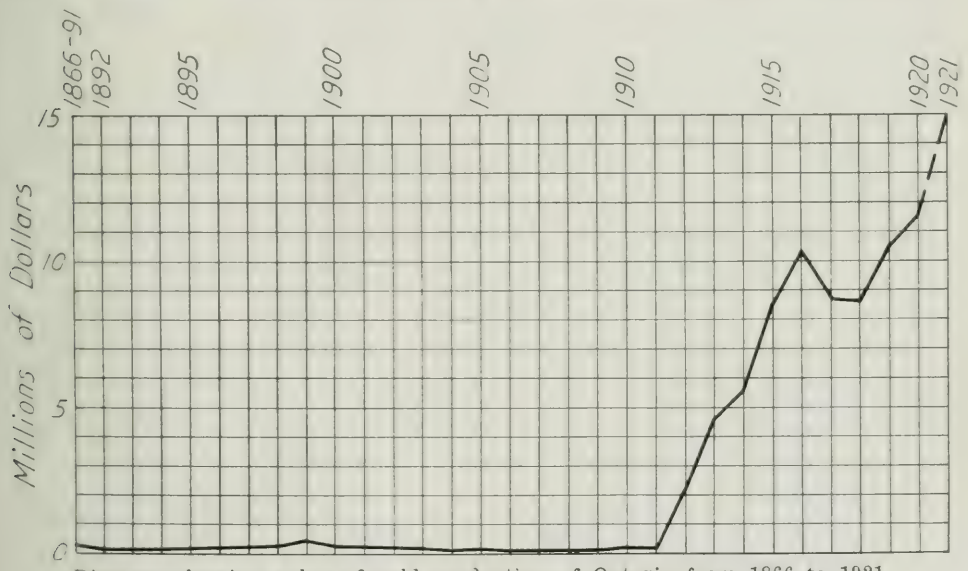


Diagram showing value of gold production of Ontario from 1866 to 1921.

Since dividend payments commenced in 1913, a total up to the end of 1921 of $23,140,734 has been returned to shareholders by gold mining companies. Ore reserves at the end of 1921 at Porcupine and Kirkland Lake amounted to approximately $60,000,000.

Pre-Cambrian Geology of Ontario

The vast extent of the pre-Cambrian rocks of Ontario is shown on the accompanying geological sketch map. By far the greater part of the surface underlain by these rocks is unprospected, and much of it is worthy of attention from the searcher for gold deposits.

Gold occurs in many varieties of pre-Cambrian rocks, particularly in those belonging to the Keewatin and Timiskamian series that have been intruded by Algoman granite and porphyry as the Hollinger, Dome, McIntyre and Tough-Oakes. Most of the gold at Kirkland Lake comes from Algoman porphyry, although in places the wall rock is syenite. A small production has come from veins in granite.

Judging from the minerals present, the pre-Cambrian gold deposits of Ontario were formed at great depth and at high to intermediate temperatures. Secondary enrichment has played no important part.

Geological sketch map of Ontario showing distribution of pre-Cambrian rocks.

The most promising gold-bearing rocks of the Province are being gradually mapped, but pre-Cambrian geology is so complex that many years must elapse before detailed maps of the whole can be prepared. The age classification used in this report is that employed by the Ontario Department of Mines, and is as follows:

Pre-Cambrian Epochs of Ontario and their Metal Production[1]

(Keweenawan)—	Epoch following basic intrusions of (a) silver, cobalt, nickel, and arsenic at Cobalt and elsewhere; (b) nickel and copper at Sudbury, and copper elsewhere. Certain gold deposits, not now being worked, appear to belong to this epoch.
Animikean—	Epoch of deposition of "iron formation" as a chemical precipitate. Includes the Cobalt and other series of sediments.
(Algoman)—	Epoch following granite intrusions, of gold at Porcupine and at many other localities, and of auriferous mispickel. Deposits of galena, zinc blende, fluorite, and other minerals appear also to have been derived from the granites, but some of them were not formed till post pre-Cambrian time.
(Haileyburian)—	Preceding the intrusion of the Algoman granites, basic intrusives, of post-Timiskaming age, gave rise to nickel and titaniferous and non-titaniferous magnetite deposits and chromite [and possibly gold].
Timiskamian—	Epoch of minor deposition of "iron formation" as a chemical precipitate, with conglomerate and other sediments.
(Laurentian)—	Granite instrusions probably gave rise to ore deposits which have been removed by excessive erosion, as is known to be the case with deposits of later origin.
Loganian { Grenville—	Epoch of deposition of extensive "iron formation" as a chemical precipitate, with limestone and other sediments.
Loganian { (Keewatin)—	Composed largely of basic lava flows, many of which are now schistose. There are also acid lava flows such as rhyolite at Lightning river, which gave rise to some gold.

In the table names of epochs that are represented essentially by igneous rocks are enclosed in parentheses.

Gold Epochs

There were probably four epochs of gold deposition during pre-Cambrian times, namely, (*a*) Keweenawan, (*b*) Algoman, (*c*) Haileyburian, and (*d*) Laurentian and Keewatin.[2] Erosion has destroyed many deposits. Those now remaining are chiefly of Algoman age.

It is often difficult to determine the epoch in which an ore body was formed. Hence, in the following pages the age given for certain deposits is to be considered only provisional.

Keweenawan.—The gold deposits of the Keweenawan are of comparatively little importance. A few small deposits, not now productive, are apparently genetically connected with Keweenawan intrusives, more especially with the later more acidic facies. They are as follows: the Crystal mine on Lake Wanapitei; the Havilah, formerly the Ophir mine, north of Thessalon; the Sudbury copper-

[1] Ont. Bur. Mines, Vol. XXIV, 1915, pp. 243-248.

[2] Haileyburian Intrusive Rocks, by W. G. Miller and C. W. Knight, Ont. Bur. Mines, Vol. XXIX, 1920, Pt. 1, pp. 235-236.

nickel deposits,[1] of which the Vermilion mine in lot 6 in the fourth concession of Denison township had the richest gold showing. The Bruce copper mines, which are in Keweenawan diabase and were first worked in 1849, carried in places small quantities of gold, as do also certain cobalt-silver ores which owe their origin to intrusives of this epoch. Portions of the prospects at Howry creek and Whiskey lake are in Animikie sediments and Keweenawan diabase. The Ogema (80 E. and 150 E., Dorion township) and other Keweenawan lead-zinc deposits in the vicinity of Black bay carry small quantities of gold and silver.

Algoman.—Other known gold deposits are presumably pre-Keweenawan in age, since diabase dikes of this age clearly intrude them as at Porcupine, Kirkland Lake, West Shiningtree, Boston Creek, Schreiber, etc. All the known important gold deposits of Ontario appear to have been formed during the Algoman epoch. They are found chiefly in Keewatin, Grenville and infolded Timiskamian sediments which have been intruded by Algoman granite and porphyry. The deposits at Porcupine, Kirkland Lake, Boston Creek, Matachewan, Deloro and elsewhere are believed to belong to this epoch.

Haileyburian.—Certain gold deposits appear to be genetically related to intrusives of this age. The Long Lake gold mine, near Sudbury, is believed to owe its origin to diorite of Haileyburian or Algoman age. The Cordova deposits are found in a gabbro-diabase mass which is post-Hastings in age and may therefore be Haileyburian. The Jamieson deposit in Robb township and the Shaft island deposit on Abitibi lake apparently owe their origin to a diabase-gabbro magma, probably of Haileyburian age.

Laurentian and Keewatin.—Following the intrusion of Laurentian granites and related rocks, doubtless gold deposits were formed that were genetically connected with the intrusives, but they have been removed, for the greater part at least, by erosion. It is difficult to prove that deposits referred by certain writers to this epoch are not of later age. The term Laurentian has been often loosely used; the same may be said of Keewatin. The Foley and other mines at Mine Centre are genetically connected with an altered granite or protogine described as Laurentian by A. C. Lawson, although A. L. Parsons refers to the rock as Algoman. The Ophir, Sultana and Saw Bill occur in a porphyritic gneiss which may be Laurentian. The Goodfish Lake deposits are related to schistose quartz porphyries which may be of Laurentian age. The fact that gold occurs in small quantities in the Keewatin rhyolites at Lightning river and other places would suggest that some of the gold may be of Keewatin age.

Placer Deposits

There are no known gold placer deposits that have been proved to be of commercial importance in Ontario. This may be due to the intense glaciation to which the country has been subjected. However, little systematic prospecting has been done as yet. Attempts have been made at placer mining on the Vermilion and Wanapitei rivers, Meteor lake, Lake Manitou (on claims H.P. 304 and H.P. 384) and Lake Savant, but the ventures were not successful. Low assays in gold can be obtained from glacial sands from various other parts of the Province, such as in Munro, McCool, Montrose, Timmins, and other townships. Where streams have cut through some glacial sands gold can be panned, as for example,

[1] Gold was also found by the Creighton Gold Mining Co., (lot 11, concessions V and VI, Creighton township) in 1889 and a mill operated for a short time in 1893.

in Grassy river. The productive gold deposits of Ontario with which this report deals are primary or lode deposits.

Types of Lode Gold Deposits

Specimens of gold ore may frequently be identified as regards locality by certain characteristics.

(1) According to the minerals present, the deposits may be divided into five classes, namely:

(*a*) *The pyrite-gold-quartz type,* in which pyrite is the predominant sulphide. The gold usually occurs with pyrite, calcite, chlorite, etc., along crushed seams in the quartz, and associated with pyrite in the mineralized schist. Certain of the following minerals may also be present in minor quantities; copper pyrites, native copper, galena, zinc blende, bismuth minerals, pyrrhotite, magnetite, mispickel, tellurides, molybdenite, scheelite, barite, tourmaline, feldspar, etc. This is the most common and most productive type, as represented by the Porcupine deposits.

(*b*) *The arsenopyrite-gold-quartz type,* in which arsenopyrite is prominent. The southeastern Ontario, Timagami, Long lake, Howry creek, and some of the Painkiller lake deposits are the only known ones belonging to this type in Ontario. Small quantities of mispickel are present in other types of deposits, such as the Sultana, Pine Portage, Keewatin, Winnipeg Consolidated, Croesus, and McAuley-Bridge in Bristol township. The Beaver Lake deposit in northern Manitoba is of this type.[1]

(*c*) *The gold-telluride veins* characterized by the presence of tellurides. Calaverite and petzite, gold tellurides, are found at the Miller Independence; both calaverite and kalgoorlite occur in No. 3 vein of the Tough-Oakes; calaverite occurs on the Boston-McRae, and petzite has been recognized at the Bourkes mine. Gold-bearing tellurides probably occur at various mines in Kirkland Lake and other places, but so finely disseminated that they are difficult to recognise. Several other tellurides have been found in various parts of the Province and, although they are non-gold tellurides, they frequently indicate rich gold ore, since native gold invariably occurs as veinlets in the tellurides. Altaite is quite common at all the mines of Kirkland Lake, while coloradoite, tetradymite and hessite (?) occur in small quantities. Other known telluride occurrences in the Province are as follows:[2] sylvanite and nagyagite at the Huronian mine (Moss township); hessite from Gold Creek, Pine Portage Bay, Lake of the Woods, and Powell claim (M.E. 20) in Deloro township; tetradymite from the Mikado mine, Raty claim (Rickard township) and from the Hattie, Treadwell, Mayot, Hill and Cartwright properties at Painkiller Lake. Tellurides not yet identified have been found on the Devanney claim (T.B. 2650) at Tashota, on claims K. 665 and H. W. 443 at Dryden, on the McKellar-Longworth claim (B. J. 122) Schreiber, on the Stitt claims in the centre of Grenfell township, on the Wisconsin-Skead, and on the Malouf, Labine-Smith and other claims on lots 9 and 10 in the second concession of Maisonville township.

(*d*) *Calcite-gold type.*—Calcite is the principal gangue mineral, there being small quantities of quartz with galena, zinc blende, pyrite, etc., as at the McQuaig and Sjolander-McKirdy claims at Big Duck lake. Some of the veins on the Argonaut (Huronia) are made up largely of calcite.

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[1] Pre-Cambrian Goldfields of Central Canada, by J. B. Tyrrell, Trans. Roy. Soc. Can., 1915, 3rd series, Vol. 9, pp. 89-118.

[2] Ont. Bur. Min. Rep., Vol. XXIV, 1915, Pt. 1, pp. 183-184; Vol. XXVI, 1917, pp. 186, 218; Vol. XXVIII, 1919, Pt. 2; Vol. XXIX, 1920, Pt. 4.

(*e*) *Copper-nickel-gold deposits.*—Some gold is recovered as a by-product from the nickel-copper ores at Sudbudy. The Whiskey lake, McGown and Skead-Gold deposits are of the copper-gold type.

(2). The shape of the deposit is a minor detail; however, according to form or structure,[1] the doposits may be classified into several groups following the descriptions of various authors who have examined them, namely:

(*a*) *"Simple" or "true fissure"* veins, in which the ore occupies a sheet-like space, with smooth walls, usually in a massive rock; examples, Mikado, Regina, Pine Portage, Foley at Mine Centre, No. 1 vein at Miller-Independence, Clifton-Porcupine, and a portion of the Rea vein at Porcupine.

Gold-bearing quartz stringers in dolomite representing the stockwork type of deposit.

(*b*) *Composite veins or lodes*, namely, a number of nearly parallel lenticular fissures irregularly connected and spaced over a considerable width with replaced country rock intervening. Most of the productive deposits are of this type. The Hollnger, McIntyre and Dome, the largest known gold ore bodies in Ontario, are of this type. Some of the Kirkland Lake deposits are lode deposits in which the quartz veins are quite narrow.

(*c*) *Sheeted zone*, e.g. minute fractures closely spaced and parallel. Examples are the Howey-Cochenour at Lightning river, and portions of the deposits in the Kirkland Lake area.

(*d*) *Stockwork.*—The stockwork type in granite, porphyry, and dolomite or ankerite is common in most gold areas. The Ferguson at Mine Centre, Gold island at Night Hawk lake, and deposits at Larder lake are examples of stockwork in these rocks.

(*e*) *Fahlbands or Shear-zones*, i.e. schist bands, impregnated with pyrite and other sulphides and containing very little quartz. Examples are Canadian

[1] The gold deposits of Northwestern Ontario were classified by A. P. Coleman in 1896, Ont. Bur. Mines, Vol. VI, 1896, pp. 115-120.

Homestake (Scramble) in northwestern Ontario, Dome Lake and Davidson at Porcupine, the Bosquet at Howry creek and the Currie prospect at Boston creek; the Elstone-Dunkin prospect in Gauthier township approaches this type.

(*f*) *Pyrite and iron formation*, comprising alternating layers of chert, sugary quartz, magnetite and pyrite, and frequently carrying a little gold. Pits and shafts have been sunk on this type of deposit in almost every gold area. The low gold contents may have been present in the rocks as they were deposited. Where secondary quartz veins intersect the iron formation, gold has in some cases been deposited, the sulphide acting as the precipitating agent for the metal. The Big Master vein, according to A. L. Parsons, shows a remarkable similarity to iron formation. The quartz of the Elizabeth at Atikokan is white and granular, like silica formed in iron formation. Typical examples are the Wright, James, Philadelphia, and Red Dog deposits at Porcupine, and the Cochrane and Gold Corona at West Shiningtree.

(*g*) *Single lens and pipe-like deposits.*—Portions of the Cordova deposits are pipe-like. The Regina and Mikado have a nearly vertical chimney or short shoot. The Long Lake gold deposit has the shape of a large vertical core or pipe.

Gold-Bearing Veins in Granite and Syenite

As stated above, the bulk of the gold comes from Keewatin basalt schists and Timiskamian sediments which have been intruded by Algoman granite and porphyry. However, gold-bearing veins in granite and syenite are common in certain parts of the Province; some gold has been recovered from fissure veins occurring in these rocks. The main veins on the Regina, Mikado and St. Anthony pass from altered granite into Keewatin schists. The Ophir is in a porphyritic granite. The Foley, Elizabeth and Harold Lake mines have also yielded gold from veins in altered granite called protogine. The U.S. Gold Mining Co., at Sturgeon lake produced a little gold from small veins in granite. Certain prospects like the Hammond Reef and Ferguson, etc., are stockworks in altered granite. Examples of gold-bearing quartz veins in granite in northeastern Ontario are Thesaurus at Matachewan, and Authier, Charest and Wisconsin-Skead near Boston Creek. Some of the Teck-Hughes ore bodies are in syenite. Other prospects in syenite are the Brookbanks, Chief and Craig at Matachewan.

Gold-Bearing Veins in Porphyry, Felsite, etc.

The most important deposits in porphyry are the lodes and fissure veins of the Kirkland Lake area, which occur in fault zones in Algoman feldspar porphyry. The Bidgood and King-Kirkland are also of this type. Near Timmins at Porcupine, practically all the gold comes from the green schist adjoining the quartz porphyry, the values in the porphyry being low or erratic. A little gold has been recovered from fissure veins in quartz-porphyry at the Little Pet, Porcupine-Porphyry Hill and Clifton-Porcupine. Gold-bearing porphyry stockworks, namely a net-work of quartz stringers in porphyry and felsite, are common in certain areas, but no deposits of this character, as yet, have been worked with success. They occur at the Champion, near Kenora, Bully Boy on Camp bay, Manitou, Boston Creek, Gold Island (Night Hawk lake), West Shiningtree, Matachewan and other places. The Ophir (Lake of the Woods) deposits are in a porphyritic

granite with phenocrysts of orthoclase half an inch wide. The acid rock at the Matachewan Gold is orthoclase porphyry. At Kirkland Lake the fine-grained, red syenite is rich in orthoclase; these rocks from the two last mentioned areas contain about 9 per cent of potash.

Depth of Mine Workings

The depth of workings of certain gold mines and prospects are as follows, the figures representing the vertical depth in feet unless otherwise stated:

Southeastern Ontario.—Deloro, 500 (incline); Cordova (Belmont), 500; Star of the East, 213.

Boston Creek and Larder Lake.—Boston Creek, 400; R.A.P., 200; Patricia (Boston-Hollinger), 215; Miller-Independence, 500; Argonaut (Huronia), 370; Harris-Maxwell (Associated Goldfields), 500; Kerr-Addison (Associated Goldfields), 300; Wisconsin-Skead, 112.

Kirkland Lake.—Kirkland Lake, 900; Teck-Hughes, 600; Orr, 400; Lake Shore, 600; Wright-Hargreaves, 600; Tough-Oakes, 500 (55° incline); Ontario-Kirkland, 450; Elliott-Kirkland, 500; Black, 155; Hunton, 100; Kirkland Combined, 200; Canadian-Kirkland, 100; Comfort-Kirkland, 150; La Belle Kirkland, 340; Fidelity, 140; Swastika, 400; Marigold (Lucky Cross), 200; Baldwin, 200; Bidgood, 400; King-Kirkland, 100; Sylvanite, 300.

Bourkes and Munro.—Bourkes, 400; Murray-Mogridge, 226; Croesus, 400 (22° incline); Burton-Munro, 318 (55° incline); Detroit-New Ontario, 183, Hill or Premier, 200; Cartwright, 100.

Porcupine.—Hollinger, 1,530; McIntyre, 1,950; Dome, 1,300; West Dome (62° incline), 350; North Dome, 325; Porcupine Crown (North Crown), 700; Vipond-North Thompson, 600; Schumacher, 600; Dome Lake, 500; Rea, 400; Davidson, 500; Foley-O'Brien, 250; Hollinger Reserve (Grey or McEnaney), 440; Hayden, 375; Anchorite, 350; Keora, 120; Clifton-Porcupine, 228 (80° incline); Plenaurum, 1,000 (drift from McIntyre); Peninsular, 180; Union, 275.

Matachewan and West Shiningtree.—Matachewan Gold Mine, 170; Thesaurus, 100; Wasapika, 200; Herrick, 150; Westree, 100; Buckingham, 105; Steep, 100; White Rock, 165.

North Shore and Michipicoten.—Long Lake, 225; Grace, 300; Shakespeare, 300.

Northwestern Ontario.—St. Anthony, 525; Saw Bill, 275; Sunbeam (A. L. 282), 43° incline, 410; Elizabeth, 280; Golden Star, 537; Foley, 420; Olive, 251; Laurentian, 480; Big Master, 285; Twentieth Century, 340; Paymaster, 325; Sakoose or Golden Whale, 165 (incline 85°); Redeemer, 235; Golden Horn or Rush Bay, 255; Regina or Black Eagle, 515; Sultana, 600; Mikado, 510; Tash-Orn, 140.

Hydro-Electric Power

The following gold mines and gold-mining areas have been or are being supplied with hydro-electric power: Porcupine, Kirkland Lake, Boston Creek, Larder Lake, Long Lake, Wawa, Canadian Homestake or Scramble, Hammond

Reef, Cordova, Deloro and Golden Fleece. The locations of the various power plants and transmission lines are shown on the accompanying maps.

Description of Gold-Mining Areas

The gold deposits of the Province, including all the producers and a number of prospects are briefly described under the areas in which they occur. The locations are shown on the accompanying maps and most of the claim numbers are given in the text. Amongst the producers, particularly in northwestern Ontario, are included many properties which have recovered a small amount of bullion from mill tests only. Owing to many of the older departmental reports being out of print it was deemed advisable to republish a number of cuts showing cross-sections through old workings, and also refer to them at greater length than some of the large present producers.

Southeastern Ontario

The Eastern Ontario gold area constitutes a narrow strip of country extending from Belmont township, Peterborough county, eastward across the counties of Hastings, Addington, and Frontenac and into the western part of Lanark, a distance of about 70 miles. It was in this area that gold was first found in the Province, in 1866, at the Richardson location. Among the most important mines were the Cordova (Belmont), Deloro, Atlas-Arsenic, and Cook. The deepest mine workings reach about 500 feet. The ores are largely of the arsenical-gold type in which the gold was recovered by various methods, namely, amalgamation, chlorination, or cyaniding. The mispickel concentrates were treated in a refinery and white arsenic was produced. The smelter at Deloro continues to operate, but since 1904, all the ores treated have been from the Cobalt silver camp. There are also quartz-pyrite gold deposits free from mispickel, such as the Cordova, Sovereign, etc.

A list of some of the important articles relating to the area is given in the foot-note below.[1]

W. G. Miller, in his report on "The Eastern Ontario Gold Belt", in 1901, summarizes the geology of the area as follows:—

> A series of diorites, crystalline limestones and various schistose rocks has been cut through by granite. . . . Overlying all the rocks mentioned are areas, here and there, of undisturbed Silurian limestone. . . . The granite was found . . . to be younger in age than either the diorite or crystalline limestone. . . . The diorite is also seen to be younger than limestone . . . Most of the gold deposits occur near the contact of the diorite and granite, although some important ones are found at a considerable distance from the granite. . . . The cavities occupied by the deposits owe their origin to the shrinkage of the granite on cooling.[2]

Some years later W. G. Miller and C. W Knight,[3] made a detailed study of seven distinct key areas in the region and described more fully the relationship of the rocks in the vicinity of some of the gold mines.

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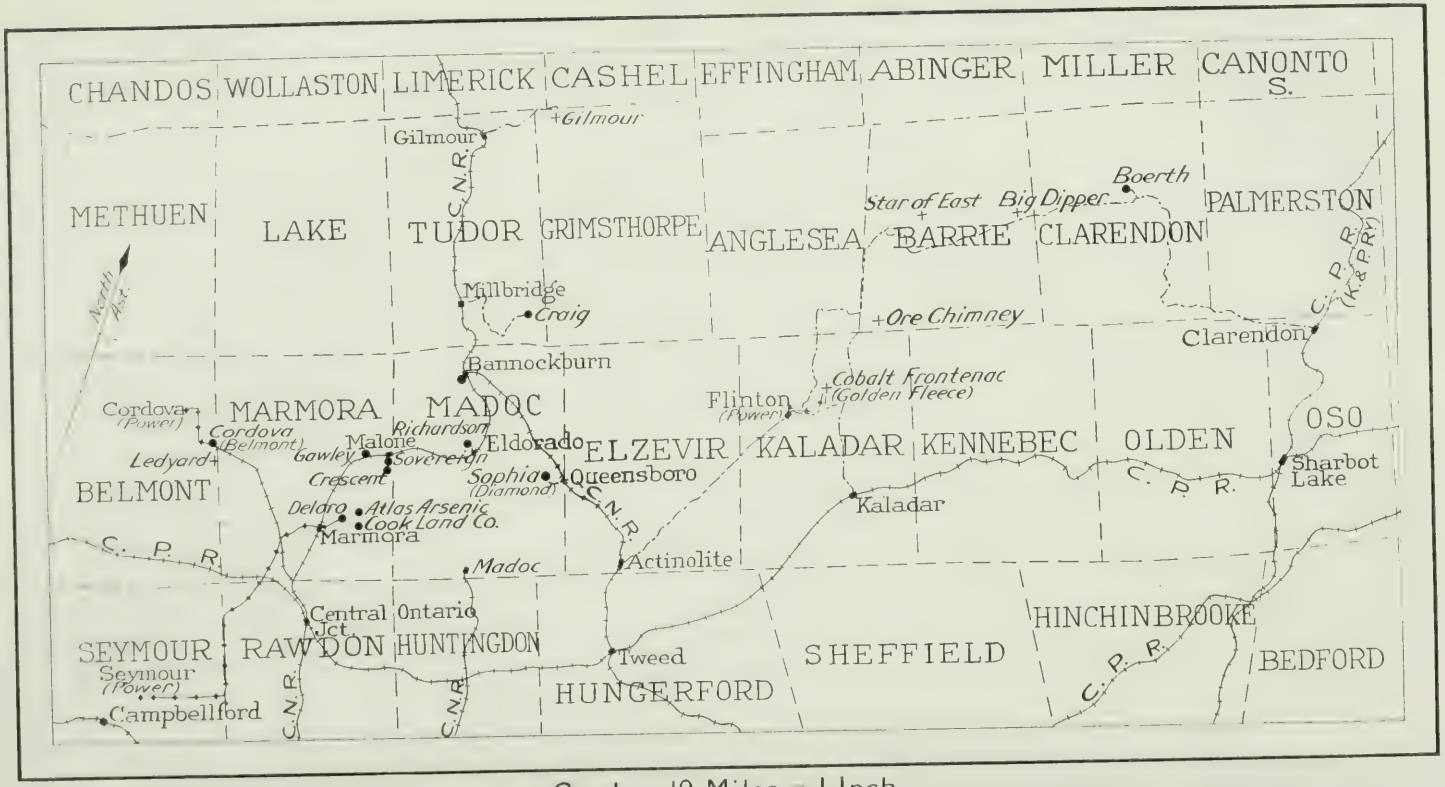
[1] Can. Geol. Surv., Report 1869, etc.; Trans. Can. Min. Inst. Vol. V. pp. 233-255 "Eastern Ontario. A Region of Varied Mining Industries" by W. G. Miller; Ont. Bur. Mines, Vol. XII, 1903, pp. 108-116, "Mines of Eastern Ontario" by W. E. H. Carter; Ibid Vol. XI. 1902, pp. 101-122, "Arsenic in Ontario" by J. W. Wells; Idem, pp. 186-207, "The Eastern Gold Belt" by W. G. Miller. Vol. XXII., 1913, pt. 2, "The Pre-Cambrian of South Eastern Ontario" by W. G. Miller and C. W. Knight; also other Annual Reports Ont. Bur. Mines.

[2] Ont. Bur. Mines, Vol XI, 1902, pp. 186-187. The term diorite in the report cited was used in a comprehensive sense, to cover dark-colored rocks of various character.

[3] Ibid, Vol. XXII, 1913, Pt. 2.



Scale, 10 Miles = 1 Inch.

10 0 10 20

Power Lines . . . Roads —.—.— Mines • Prospects +

Key map showing location of gold mines and prospects in Southeastern Ontario

The *Cordova* (*Belmont*) mine occurs in and is genetically connected with a gabbro-diabase mass of post-Hastings age: The *Sophia* or *Diamond* mine (lots 14 and 15, concessions X, Madoc township) has visible gold, and mispickel in a quartz-calcite gangue, occurring in a Keewatin hornblende schist,[1] and near a felsite intrusion. The *Golden Fleece* or *Cobalt Frontenac* (west ½ lot 24 and lot 25, concession VI, Kaladar township) occurs at the contact of Keewatin green schist and Hastings conglomerate, the deposit consisting of schist, quartz, pyrite and gold. A production of approximately $10,000, was obtained from a 10-stamp mill. A hydro-electric power plant at Flinton now supplies the mine. The *Ore Chimney* (lots 34 to 36 in concession 1, Barrie township) is a prospect occurring on a similar contact about 5 miles northeast. The company is building a hydro-electric power plant on the Scootamatta river.

The *Deloro*, which is the best known gold mine in Eastern Ontario, and the following adjoining properties, *Atlas-Arsenic* (Lot 10, concession IX, Marmora township); *Cook* (lots 7, 8, and 9, con. IX, and lots 10, 11, and 12, con. X, Marmora township); *Sovereign* (lot 17, con. XI, Marmora township); *Gawley* (lot 18, con. IX, Marmora township), *Crescent* (lots 16 and 17, concession XI, Marmora township); and the *Richardson* mine (lot 18, con. V, Madoc township), all occur near the edge of a granite boss, Algoman in age, which intrudes Keewatin green schists and Grenville limestone. The deposits, except the *Sovereign*, consist of irregular quartz veins containing gold and mispickel, and are genetically connected with the Algoman granite.

A few other properties in the area may be mentioned; the *Gilmour*, which lies five miles east of the village of Gilmour in lot 30, con. XIX, Grimsthorpe township, was operated from 1909 to 1914, and yeilded $24,348.54 with a 5-stamp mill. *The Craig* gold mine, which is situated on the south halves of lots 4 and 5, in the third concession of the township of Tudor, has a shaft 150 feet deep on a quartz vein from 5 to 12 feet wide, and in 1905 yielded a small quantity of gold by a 6-stamp mill. The *Star of the East* (lot 24, con. X, Barrie township), also produced some gold by a 10-stamp mill in 1905. The vein consists of quartz lenses highly impregnated with pyrites occurring in crystalline limestone near diorite[1]. The workings are 213 feet deep. The *Big Dipper Mining Co.* are interested in lots 4 to 21 in the tenth concession of Barrie township. Considerable work has been done on quartz veins carrying pyrite, magnetite and some gold in limestone near granite.[2] The *Boerth* mine, (*Clarendon Mining Co.*), which is situated in lot 28 of the seventh concession of Clarendon township, produced some gold bullion in 1899. According to W. G. Miller:[3]

The deposits of auriferous mispickel and quartz occur near the contact of diorite and crystalline limestone. . . . Some of the quartz veins run across the strike of the rocks. Tourmaline occurs at times mixed with the mispickel, and the ore containing this mixture is said to be the richest in gold.

Rich gold specimens came from the *Bannockburn* deposits (lot 28, con. V, Madoc township) which consists of quartz stringers and pyrite in diorite schist. Some bullion was recovered with a 10-stamp mill.

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[1] Ont. Bur. Mines, Vol. XXII, 1913, Pt. 2, p. 111.

[2] Ibid, Vol. XV, 1906, p. 89.

[3] Ibid, Vol. XI, p. 203.

The two chief properties, the Cordova and Deloro, are more fully described in the following paragraphs.

Cordova (Belmont).—(E. half lot 20, con. I, Belmont township). From its discovery in 1897 up to the end of 1903 the mine produced 16,790 ounces of gold bullion valued at $289,302.[1] The mine lay idle from 1903 until 1911, when it was re-opened by P. Kirkegaard and worked almost continuously until the plant was burned in 1917, producing an additional amount of bullion valued at $45.180 in gold and $299 in silver. The total production therefore was $334,781. Before the fire the mine was equipped with 30 stamps, Wilfley tables and a cyanide mill operated by electricity supplied from the company's own hydro-electric power at Deer lake, 2½ miles distant.

W. G. Miller and C. W. Knight, describe the deposit as follows[2]:—

The ore-bodies occur in a coarse-grained gabbro-diabase which invades the Grenville and Hastings series. The veins are of quartz, with which are associated iron pyrites, feldspar and calcite. The wall rock has been altered to a chlorite schist, or chlorite-mica schist, sometimes 50 feet wide, there being a gradual transition between the fresh gabbro-diabase and the schist. The latter is impregnated with quartz veinlets parallel to the schistosity. Consequently, there is not a definite boundary line between the ore and the schistose wall rock. The ore body is low-grade, the hand-culled material which is treated in the mill averaging between $5.00 and $6.00 per ton. The deposits may have been formed by hot solutions which followed the intrusion of the gabbro-diabase.

Speaking of the rocks in which the ore occurs they remark[3]:

The gabbro-diabase series is important from an economic point of view, as in it at Cordova are the auriferous veins of the Cordova mine.

The gabbro-diabase is classed as Keweenawan (?) but it may be Haileyburian or Algoman in age.

W. G. Miller also states[4]:

The large ore bodies are found at points of intersection of two fissures, and come to the surface in some cases in the form of what may be called chimneys. . . . Mispickel, which is characteristic of the Deloro and other properties farther east on the gold belt, does not occur here. Pyrrhotite, galena and copper pyrites are met with at times.

Ledyard.—Adjoining the Belmont or Cordova is the Ledyard gold mine (east half lot 19, concession 1, Belmont township), which in 1897 had a 20-ton mill and a shaft 100 feet deep.

Deloro.—The property includes lot 9, concession VIII, and adjoining lots in Marmora township, and was formerly known as the Gatling. It was operated by the *Canadian Goldfields Company, Limited*, a British concern, and has been described in the Reports of the Geological Survey and of the Bureau of Mines. Miller and Knight say[5]:

The ore bodies consist essentially of quartz lenses in the schist which contain visible gold and mispickel. The lenses conform to the strike of the schist, and cut across dikes of granite which intrude the latter. Near the surface the ore was com-

[1] Can. Min. Inst. Trans., Vol, VII, 1904, p. 120.
[2] Ont. Bur. Mines, Vol. XXII, 1913, Pt. 2, p. 110.
[3] Idem, p. 33.
[4] Ibid Vol, XI, 1902, pp. 190-191.
[5] Ibid, Vol. XXII, 1913, Pt. 2, p. 110.

paratively rich, but the value gradually decreased in depth. At a depth of 500 feet in the inclined shaft, the gold represented only two or three dollars a ton, but massive mispickel was present. Two factors contributed to the closing of the mine, viz., the encountering of a heavy flow of water in the lower levels, and the discovery of rich arsenical ores at Cobalt. Deloro was the pioneer white arsenic producer in North America, but the ores now treated there all come from Cobalt.

The Deloro, at times, ran 20 stamps and had a cyanide plant for treatment of its concentrates. During the five year period of operation from 1899 to 1903, 35,877 tons of ore were raised and milled from which the total value of gold recovered was $181,907.55, and of arsenic $128,975.50, making a grand total value of $310,883.05, or of $8.66 per ton.[1] The present Deloro smelter is operated by hydro-electric power furnished by the Hydro-Electric Power Commission of Ontario from its plant at Campbellford.

Parry Sound District

McGown.—In 1894 gold-copper ore was discovered at the McGown mine, on lots 146, con. A. and B., Foley township, two miles east of the town of Parry Sound. In 1898 a 10-stamp mill was erected. According to A. P. Coleman[2] the deposit consists of "an irregular bedded vein about 3 feet wide containing quartz mixed with dark schistose rock and carrying some free gold and copper ores, especially bornite and chalcocite. Much of the geology corresponds to the Grenville series or Upper Laurentian of Eastern Ontario and Quebec, or to the Keewatin rocks of Western Ontario."

The McGown and neighbouring deposits were found on developing to be pockets which were more valuable for copper than for gold. Several car-loads of ore were shipped to a smelter and yielded 15.8 per cent. of copper with a little less than an ounce of silver and $5.00 in gold to the ton.

North Shore of Lake Huron.

In this region isolated properties have yielded gold intermittently from 1892 to the present, the most important producer being the Long Lake mine. Many of the deposits belong to the Keweenawan epoch.

Crystal.—The Crystal gold mine (W.D. 14, Rathbun township), the only producer at Wanapitei lake, where gold was found in 1888, operated for a period of years following 1892. According to W. H. Collins[3] the deposit consists of narrow quartz veins carrying pyrite and gold at and near the contact of Keweenawan diabase and Cobalt sediments. Mispickel, chalcopyrite and pyrrhotite are also present. A small production was obtained from a 5-stamp mill. Other prospects in the vicinity are the *Gordon, Mondoux, Last Chance* and *Comstock.*

Havilah.—This mine, formerly the *Ophir,* in lot 12, in the third concession of Galbraith township, is also at the edge of a Keweenawan diabase intrusion, and is quite similar to the Crystal deposit. The vein was worked at intervals from 1892 to 1902 and was among the producers again in 1910 and 1911. During 1921 the Havilah and the Bass Lake property, 3 miles northwesterly, were taken over by *Kirk Gold Mines Company, Limited.* The Havilah mill is now being overhauled and a cyanide plant installed. According to T. L. Tanton, the Bass Lake vein is a dark quartz carrying visible gold and lying entirely in Keweenawan diabase.

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[1] Jour. Can. Min. Inst. Vol. VII, 1904, p. 121, by W. E. H. Carter.
[2] "Copper in Parry Sound" Ont. Bur. Mines, Vol. VIII, 1899, pp. 259-262.
[3] Onaping Map Area, by W. H. Collins, Memoir 95, Can. Geol. Surv. p. 12, 114.

Long Lake.—This mine[1] (W.D. 602), is situated near the southwest end of Long lake, in Timber Berth No. 69, and is reached by a 10-mile wagon road from Naughton station, 11 miles west of Sudbury. The property was purchased by the Canadian Exploration Company, Limited, who mined 150,000 tons of ore averaging about $6.00 per ton in gold which was successfully treated by a 10-stamp mill and a cyanide plant. The bullion production from 1910 to 1916 amounted to 142,265 ounces containing $829,281 in gold and $262 in silver. The mine was supplied by electricity from the Wanapitei power plant. According to M. B. Baker, Timiskamian feldspathic quartzite is cut by diorite and Algoman granite, the intrusives probably being from the same magma. The diorite, which is considered to be the source of the gold, has within it a large vertical core of quartzite mineralized with fine-grained arsenopyrite, pyrite and small quantities of pyrrhotite, galena and copper pyrites. This formed the ore body, which has been cut by post-Keweenawan faults. The diorite may be Haileyburian or Algoman in age. The known ore body was mined and milled, and the faulted portion could not be found on the 225-foot level.

The *Sudbury* copper-nickel ores, of which the *Vermilion* mine in lot 6, con. IV, Dennison township is the richest, yield some gold.[2]

The *Bruce* copper mines which were first worked in 1849 carry small quantities of gold in parts. The deposits occur in and are genetically connected with Keweenawan diabase.

Shakespeare.—Gold was found on lot 5, concession one, township of Shakespeare, in 1903, and work continued until the fall of 1907. During 1905, 1906 and 1907, $38,327 in gold was recovered by a 10-stamp mill. The mine is referred to in the Ontario Bureau of Mines Reports for these years. W. E. H. Carter states that "The ore is made up of interbanded lenses and stringers of quartz and chlorite schist . . . . . The contact with the granite lies to the north on the other side of the valley, probably half a mile away."[3] The lode is 40 feet wide, having an ore zone on either side. Iron pyrites is the principal sulphide. A shaft with several levels has been sunk to a depth of 300 feet or more.

Howry Creek.—Gold was found here in 1911 and reported on by A. P. Coleman[4] and W. H. Collins.[5] The veins are found in Animikie quartzite and conglomerate and in Keweenawan diabase. According to Dr. Collins "They [the ore deposits] are chiefly well-defined quartz veins . . . composed of white quartz and ankerite carrying arsenopyrite and free gold. . . . One of the deposits [mining locations 3180-81-82, the *Bosquet,* now operated by R. R. Tough, of Haileybury] is simply a broad sheared zone in conglomerate, which has been hydrothermally altered and filled with a plexus of quartz veinlets." The *Howry Creek* main vein (S. 2279, 2782, 2783 and S. 3673), consists of altered quartzite, quartz, ankerite, arsenopyrite, pyrite, and a little chalcopyrite in quartzite near diorite. The

[1] Pre-Cambrian Rocks North of Lake Huron, by A. P. Coleman, Ont. Bur. Mines, Vol. XXIII, 1914, Pt. 1, pp. 202-236; Long Lake Gold Mine, by M. B. Baker, Ibid. Vol. XXVI, 1917, pp. 157-162.

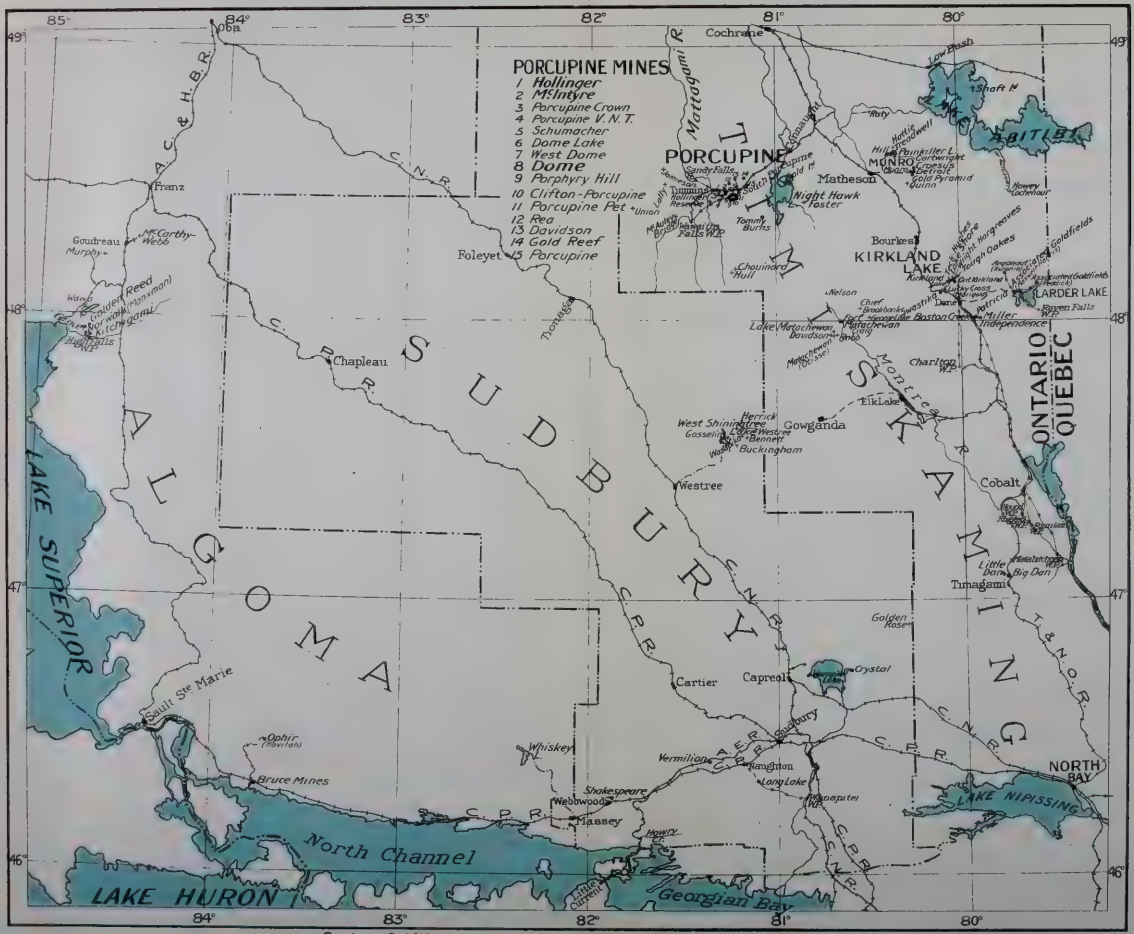
[2] R. L. Peek, in the Feb. 1922, issue of the Bulletin of the Canadian Institute of Mining and Metallurgy, calculates from analysis of the Sudbury matte that 60,400 ounces of gold were contained in matte produced to the end of 1920. According to the Royal Ontario Nickel Commission Report, page 43, the only gold produced of any account in the Sudbury copper-nickel area came from the Vermilion mine and from the refining of the nickel-copper ores.

[3] Ont. Bur. Min. Vol. XIII, 1904, pp. 70-71.

[4] Ont. Bur. Min., Vol. XXIII, 1914, Pt. 1, p. 224.

[5] Can. Geol. Surv. Summary Report 1917, pp. 10-13E.

To accompany Report by P. E. Hopkins in Vol. XXX Part 2, Ontario Department of Mines Report, 1921



Key Map of Part of Northern Ontario showing the Location of Mines that have produced Gold.

Note—Owing to the small scale of the map all prospects cannot be shown.

Majestic Gold Mines Limited are interested in claims S. 4706, S. 4730 and S. 4731. The vein being tested in 1921 is in quartzite or arkose, and consists of quartz, white, grey, and in places almost black. Not much mineralization is visible on the surface, but occasional bunches of pyrite are encountered in sinking.

Whiskey Lake.—In 1912 gold was found on the *Wilson* claim, Whiskey Lake, which lies 30 miles by lumber road to the northwest of Massey station. According to A. P. Coleman, the gold occurs in Lower Huronian quartzite and slate near greenstone, and in a green schist near the contact of sedimentary rocks including limestone. Granite outcrops a mile north of the principal showings. "The ore as disclosed is rusty quartz containing, where not too much weathered, pyrite, pyrrhotite and a little copper pyrites and galena. Free gold could be seen at a number of places."[1]

W. H. Collins,[2] states that the ore bodies are in Huronian (Bruce series) sediments close to intrusive bodies of diabase or in the diabase itself."

Michipicoten and Goudreau

Gold was found south of Wawa lake in 1897, and has been mined at intervals since then. Geologically coloured maps of the area by A. P. Coleman and A. B. Willmott,[3] J. M. Bell,[4] A. P. Coleman,[5] and W. H. Collins[6] have been published. The *Grace* (D. J. 7, or No. 1052), was the first producer in the area. Small productions also came from the *Manxman* or *Norwalk* (No. 1279) *Kitchegammi* (C B. 2, Y. 337) and *Golden Reed* (1239). According to J. B. Tyrrell the vein of the *Kitchegammi* is on the contact of a hornblende granite gneiss and an intrusive biotite granite. The mills were run by hydro-electric power supplied by the Algoma Power Company at High Falls, Michipicoten River. The deposits are lodes, containing sugary and glassy quartz carrying pyrite, pyrrhotite, chalcopyrite, arsenopyrite and visible gold with intermixed schist. They occur in Keewatin sericite schists and quartz porphyries not far from post-Keewatin granite and gneiss. The iron formation of the area carries small quantities of gold, e.g., at the *Emily*. "The location including the Helen mine itself was first staked as gold-bearing, but soon turned out to be of vastly greater importance as an iron mine."[7]

Grace, the most important mine of the area, produced during 1902, 1903, 1907, 1908 and 1910, gold bullion valued at $71,124.

On the first level at a depth of 100 feet the ore has been stoped out for 150 feet along the vein and to the level. In the north drift on this level, 90 feet from the shaft a winze has been put through to the second level stope. At the second level 200 feet in depth, the drifts north and south are 100 feet and 180 feet in length. The north stope has been carried through to the first level, while south of the shaft stoping is being done. On the third level at a depth of 300 feet drifts have run north and south 80 feet and 50 feet respectively. No stoping has been done on this level. [8]

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[1] "The Whiskey Lake Area" by A. P. Coleman, Ont. Bur. Mines, Vol. XXII, 1913. Pt. 1, p. 154.

[2] Can. Geol. Surv. Summary Report, 1917, pp. 8E-10E.

[3] "Michipicoten Iron Ranges," Scale 2 miles to the inch. Ont. Bur. Mines, Vol. XI, 1902.

[4] "Michipicoten Iron Ranges," Ibid, Vol. XIV, 1905.

[5] "Iron Ranges of Southeastern Michipicoten," Ibid, Vol. XV, 1906.

[6] "Ore Deposits of Goudreau and Magpie," Summary Report Can. Geo. Survey, 1918, Pt. E.

[7] Ont. Bur. Mines, Vol. XV, 1906, p. 175.

[8] Ibid, Vol. XVIII, 1909, p. 91.

McCarthy-Webb.—Gold was found on the claims (F.S.M. 2049-2052) near Goudreau in 1918. According to W. H. Collins[1] gold can be seen in quartz veinlets in narrow shear zones in an ash-grey feldspar porphyry resembling granite gneiss.

Murphy.—In April, 1921, a promising discovery of rich gold in quartz was made on the *Murphy* claims, 407 and 408, three and one half miles southwest from Goudreau. These claims are known as the *Goudreau Gold Mines.* An electrically driven 10-drill compressor is being installed. Other important discoveries have been made on the *Morrison* (2075), *Cline,* (2184, 2186 and 2189) and others.[2]

Gold-Mispickel Deposits near Timagami

Big Dan.—Gold-mispickel ore has been mined and shipped from the *Big Dan* and *Little Dan* properties which are situated about 2 miles north of Timagami station. The deposits have been described in various Reports of the Ontario Bureau of Mines: by A. P. Coleman[3] W. G. Miller[4] W. E. H. Carter[5] and E. T. Corkill[6]. In 1919 C. W. Knight[7] mapped an area in the vicinity of Cedar and Net Lakes which included these two deposits and described them in detail. According to Mr. Knight's report "The ore body (on the Big Dan, W.D. 271) occurs in a sheared and brecciated zone in basalt of Keewatin age . . . .The ore occurs in small veinlets and in grains through the rock . . . .It consists of mispickel, iron pyrites, copper pyrites and pyrrhotite . . . The shear zone . . . is gossan-stained on the surface, and has a width at the tunnel of about 50 feet and a length of about 1,000 feet . . . The origin . . . is uncertain[8]."

Little Dan.—This deposit on W.S. 13, W.S. 14, according to Mr. Knight, is similar in occurrence to the Big Dan. John E. Hardman, who was associated with the property some years ago when it was being worked, informed Mr. Knight that there were lenses of fine mispickel encountered from one to 18 inches wide. About 270 tons of mispickel were shipped and the gold and arsenic contents were paid for[9].

Golden Rose.—Some gold was obtained from this claim on the east shore of Emerald lake during parts of 1915 and 1916[10]. The ore contains much copper pyrites. The deposit was discovered about 1897.[11]

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[1] Can. Geol. Surv., 1918, Pt. E.

[2] Ont. Dept. Mines, Goudreau Gold Area, Press Bulletin (July, 1921) by A. G. Burrows. These notes were later incorporated with Vol. XXX, Part IV.

[3] Ont. Bur. Min., Vol. IX, 1900, p. 173.

[4] Ibid, Vol. V, 1901, p. 179.

[5] Ibid, Vol. XIV, 1905, Pt. 1, pp. 73-74.

[6] Ibid, Vol. XV, 1906, Pt. 1, pp. 87-88; Vol. XVIII, 1909, Pt. 1, pp. 132-3.

[7] Ibid, Vol. XXIX, 1920, Pt. 1, pp. 214-219.

[8] Idem, pp. 214, 216.

[9] Idem, pp. 218.

[10] Ibid, Vol. XXV, 1916, p. 103.

[11] Ibid, Vol. X, 1901, p. 175.

Boston Creek and Skead[1]

Boston Creek.—Gold has been produced at only two properties in the area, namely, the Patricia and the Miller-Independence. Both mills have been burned. The gold occurs in veins, stockworks and fahlbands in Keewatin rocks and in Algoman porphyries and granites.

The first discovery in 1914 was on the Kenzie vein, which extends from the *R.A.P. Company* (L. 5163) to the *Boston Creek* (L. 3665). The vein is 5 feet wide and consists of greenish quartz and some reddish calcite, with inclusions of silicified basalt and reddish porphyry carrying gold, pyrite, chalcopyrite, molybdenite and galena. The workings to the 400-foot level show that there are a few small shoots of high-grade ore, while most parts of the vein are barren. Gold, tetradymite and petzite (?) were discovered in a flat fissure quartz vein on the *Miller-Independence* (S. ½ lot 1, concession VI, Pacaud township), in July, 1915. This vein extends easterly on to the adjacent property, *Connell-McDonough*. In 1918 an ore shoot carrying calaverite, a precious telluride, was found on the Miller-Independence. The calaverite occurs as veinlets in copper pyrites and quartz stringers, the deposit being roughly 160 feet in length on the dip, about 50 feet in length along the strike and 3 feet in width between two faults, in Keewatin basaltic lava, altered to calcite, ankerite, or some other carbonate. Prospecting has been carried on at the 500-foot level. The mine is run by hydro electric power.

The *Patricia* (*Boston-Hollinger*), the two north claims in lot 3 concession VI, Pacaud township, has three ore shoots of a good grade, 25, 80 and 130 feet in length and one to three feet wide. A fahlband carrying low contents of gold occurs on the *Currie prospect* (L. 5037, Boston township). At the north end of the *Boston-McRae* (N. ½ lot 2, concession VI, Pacaud township), there are a few small quartz lenses carrying native gold, calaverite, and pyrite in altered basalt. Gold occasionally associated with a telluride occurs in veinlets in the granite on the *Authier* (L. 5025, Boston township), *Charest* (L. 5505, McElroy township), *Gold Leaf* (L. 5757, Boston township), and in a porphyry stockwork on the *Catharine Gold* (N. ½ lot 10, concession IV, Catharine township). The *Peerless* claim, No. 5266, formerly the *Mondoux,* has a 250-foot shaft on a quartz vein, certain portions of which carry considerable native bismuth, galena, cosalite and some zinc blende, pyrrhotite, pyrite, chalcopyrite and native gold in Keewatin greenstone. The *Ivanhoe* (L. 5079, Boston township), also has considerable native bismuth carrying gold. A 130-foot shaft has been sunk on the *Kennedy-Boston* (S. ½, lot 11, concession VI, Catharine township), on a narrow fracture carrying pyrite and visible gold in places. The *Walsh-Taylor* deposit, in the N.E., ¼ of the S. ½, lot 5, concession III, Catharine township, consists of a stockwork in rusty carbonate. The *Roger-Barnett* (N. ½ lot 5 concession III, Catharine township), and the *Honslow* (S. ½, lot 4, concession 1, Catharine township), are also of the stockwork type in pillow lava altering to carbonate, and carry considerable visible gold.

Skead township.—Quartz veins carrying gold, but only prospected in part, have been found in various types of rock in Skead township, namely, in granite and porphyry on the *Wisconsin-Skead* (L. 4353) and *Sampson* claim (lot 10, cor

[1] Boston Creek Gold Area, by A. G. Burrows and P. E. Hophins, Ont. Bur. Min., Vol. XXV, 1916, Pt. 1, pp. 244-259; Boston-Skead Gold Area, Ont. Dept. Mines, Vol. XXX, 1921, Pt. 6.

cession VI); in granite-porphyry on the *Flanagan* claim, (lot 7, concession III); gold occurs with specular hematite, pyrite and chalcopyrite in andesite on the *Skead Gold Mines*, (N. ½, lot 2, concession II), Telluride Syndicate (S. ½, lot 2, concession II), and *Nigger* (M.R. 3); in porphyry on the *Manley-O'Reilly* (L.S. 128), *Lincoln-Nipissing* (C.E. 3, C.E. 4); *Zenith Gold* (Lot 1, concession VI) on the adjoining *Cook* claim (1041) in Hearst township; and in chert on the *Fidelity*. (L. 238).

Larder Lake and Vicinity [1]

Gold was discovered at Larder Lake in 1906, and since then development has been carried on at a few properties. The total production is approximately $50,000, mainly from the Argonaut, formerly La Mine D'Or Huronia, with a small contribution from the Harris-Maxwell and Reddick which now belong to the Associated Goldfields. The three properties are furnished with electric energy supplied from the Raven Falls power plant. Larder Lake is reached by a 17-mile wagon road from Dane station. The rocks comprise Keewatin volcanics and ferruginous carbonates and iron formation. The rusty-weathering carbonates are intersected by veinlets of quartz, which carry much of the gold of the area. Associated with the Keewatin are slate and conglomerate which are in part Timiskamian in age. Cutting the above mentioned rocks are dikes of Algoman (?) porphyry, felsite, and lamprophyre, which appear to be responsible for the gold. Lying on all these rocks are the erosion remnants of Cobalt sediments which are in turn cut by Keweenawan diabase.

Argonaut.—(L. 2587, Gauthier township), has been mapped and reported on in detail by C. W. Knight [2] who states:—

There are said to be more than a score of veins, all of them containing gold, on the Argonaut property. Some of the 'veins' appear to consist mainly of felsite or feldspathic material in which occur magnetite, copper pyrites, pyrite and gold. Other veins are made up mostly of calcite, while still others consist mainly of quartz. It may be added that copper pyrites is a characteristic mineral in many of the ore bodies. Most of the veins strike northeastward and have more or less vertical dips. There has been about 1,400 feet of underground work done up to the spring of 1920.

The narrow quartz veins are in Keewatin basic schists. The total production up to the end of 1920 was approximately $33,000. The 15-ton mill continued to operate until it was burned in the summer of 1921.

The Associated Goldfields have been carrying on development work for several years at two or three of their properties; e.g. *Harris-Maxwell* (H.S. 114, 115, Hearst township), the *Reddick* (H.J.B. 29, 30, McGarry township), *Kerr-Addison*, etc. The mineral deposits are of the stockwork type, namely, ferruginous carbonate intersected by irregular quartz and calcite veins carrying pyrite, galena, tourmaline, gold, etc. One shaft has reached a depth of 500 feet, and much diamond drilling has been done.

Gold occurs in aplite on the *Gold King*.

Katrine Township.—About 1907, gold was discovered on claims H.S. 238 and 241, which are situated in southeast *Katrine township*, 6 miles north of Larder lake. In 1919 the claims were re-staked by Geo. Tucker and optioned to the Nipissing Mining Co., who did considerable testing during the year. According

[1] Ont. Bur. Mines, Vol. XVI, 1907, pp. 202-218, by R. W. Brock; Ibid, Vol XVII, 1908, pp.10-11,by N. L. Bowen; Geol Survey Can. Mem. No. 17-E, 1912, by M. E. Wilson; Ont. Bur. Mines, Vol. XXVIII, Pt. II, 1919, pp. 71-77, by P. E. Hopkins.

[2] Ibid, Vol. XXIX, 1920, Pt. III, pp. 65-76, by C. W. Knight.

to C. W. Knight, the gold-bearing quartz veins occur in a stock-like mass of Algoman mica syenite, porphyritic in places and cutting Keewatin basic volcanics. "These veins vary in width from a few inches to 4 or 5 feet or more . . . The veins consist mainly of quartz, and contain also iron pyrites, copper pyrites, specularite, galena and at times considerable ankerite. . . . There were no assays made which showed the absence of gold. . . . No free gold was seen in any of the veins, but gold could be obtained on panning."[1]

Elstone-Dunkin.—On this property (claims L. 3891 and L. 3893, Gauthier township), 6 miles northwest of Larder Lake, gold was found in 1916. It occurs in a mineralized zone or fahlband, in altered pillow lava, 20 feet in width, which is cut by Algoman feldspar porphyry.

A section exposed in one cross trench shows from the northeast hanging-wall of greenstone 6 feet of fine-grained greenish altered rock, 4 feet of reddish porphyry greatly fractured and containing a number of quartz veinlets, one foot of fine siliceous material resembling chert with parallel bands of fine grained iron pyrites and lenses of white quartz in the direction of the schist, and seven feet of similar rock to the greenstone section just described. [2]

In 1921 gold was found in a narrow quartz vein in porphyry on the *Tobico* (L.9532), ¾ of a mile northeast of the Elstone-Dunkin.

Crown Reserve.—A porphyry dike 30 feet wide and carrying encouraging gold values was diamond drilled in 1921. The claim lies about a mile northeast of the Harris-Maxwell.

Kirkland Lake, Lebel, Goodfish Lake and Swastika [3]

Kirkland Lake is the second most important gold-producing area in Ontario. Up to the end of December, 1920, the production of gold with some silver amounted to $4,021,473. The producing mines are situated along a fault zone 2½ miles in length. In this zone there are irregular low to high-grade ore-shoots of various sizes. These are lode or composite vein deposits of the gold-telluride type. The fractured zone contains several faults, some of which are later than the gold, and crosses the various rocks in its path, including Timiskamian conglomerate, Algoman syenite, porphyry and lamprophyre, all the intrusions being differentiation phases from the same magma, which is believed to be the source of the gold. The ore minerals are native gold with small quantities of calaverite, kalgoorlite and hessite. Coarse calaverite has been recognised only on the Tough-Oakes, but it probably occurs finely disseminated in the adjoining deposits. The lead telluride, altaite, is common, while coloradoite and tetradymite have rarely been encountered. Other minerals present are iron pyrites, copper pyrites, molybdenite, graphite, barite, galena and zinc blende in a gangue of the enclosing rock (syenite, porphyry or conglomerate), with quartz and a little calcite. All the ore is similar in appearance and is reddish in colour, due to the included porphyry. The ore-shoots vary in width from 3 to 40 feet, and in grade from $5.00 per ton to $30.00 or more. The six producers will probably have a production of $2,000,000 during 1922. The operating mines are briefly described, commencing at the west and taking them in order to the east along the main zone.

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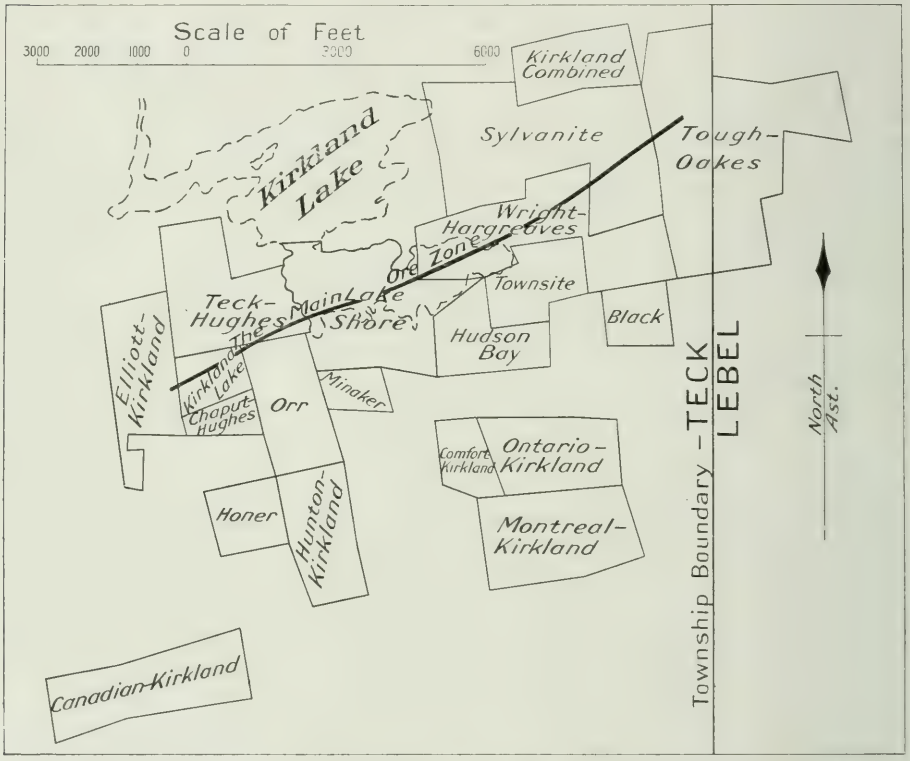
[1] Ont. Bur Mines, Vol. XXIX, 1920, Pt. 3, pp. 24-25.

[2] Ibid, Vol. XXVI, 1917, p. 257, by A. G. Burrows.

[3] Ibid, Vol. XXIII, 1914, Pt. II, pp. 1-39; Ibid, Vol. XXIX, 1920, Pt. IV, pp. 1-48, by A. G. Burrows and P. E. Hopkins.

Kirkland Lake Mine (L. 1236) has a 140-ton mill and is milling ore from a large shoot which extends from the 250-foot to the 900-foot level, the greatest depth reached in the area. Other rich shoots have been encountered further west on the lower levels.

Teck-Hughes (L. 1238, etc.) has stoped ore up to 40 feet in width from the 600-foot level nearly to the surface. The ore is put through a 150-ton mill, the extraction being over $9.00 per ton.

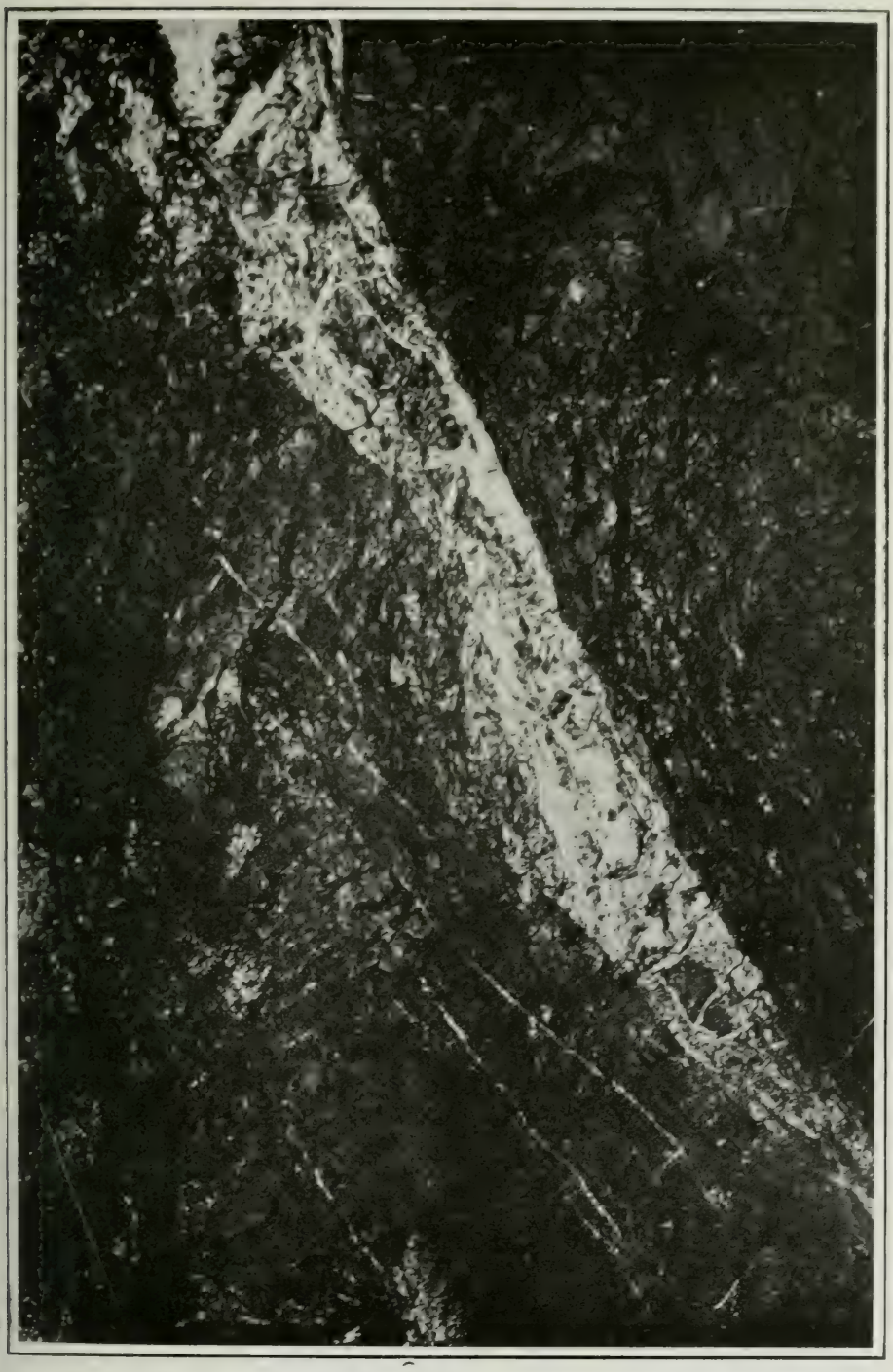


Plan showing location of several properties at Kirkland lake, in the vicinity of the main ore zone.

Lake Shore (L. 2645, L. 2605, L. 2606, L. 1557 and No. 16635) has two veins 400 feet apart with mine workings 600 feet in depth. The stopes average about 11 feet in width. During 1920 the 60-ton mill treated 19,779 tons of ore from which was recovered $502,113 in gold and $1,622 in silver, or at the rate of $25.47 per ton milled.

Wright-Hargreaves (L. 2103, L. 1829, L. 1830, etc.) has deposits similar to the Lake shore opened up to a depth of 600 feet. The mill which commenced operating in May 1921 treats daily about 175 tons of ore running approximately $12 to the ton. The vein is almost ¾ of a mile in length on the surface.

Tough-Oakes (L. 2372-L. 2376, L. 1823), with which is amalgamated the *Burnside*, was the first producer in the area. The mine yielded $1,933,955 from



Quartz vein (No. 3) in porphyry, Tough-Oakes mine, Kirkland Lake area.
(Ont. Bur. Mines, Vol. XXIX, Pt. 4, p. 39).

three narrow parallel veins which passed from porphyry into conglomerate. The ore averaged $20 to $75 per ton across 5 feet. Coarse calaverite came from No. 3 vein. The mine was re-opened in 1921 and is expected to be producing again in 1922. The capacity of the mill is 125-daily.

Other prospective producers on the main zone and having apparently similar deposits are the *Orr* (T. 16626), which has developed ore on the 400-foot level, and the *Sylvanite* (L. 2100, L. 2226, etc.), which is being systematically developed at the present time to a depth of 300-feet. The *Elliott-Kirkland* on the west has a shaft sunk 500-feet on the main fracture.

About three-quarters of a mile south of the main ore zone are a number of prospects mentioned in order from west to east; *Canadian Kirkland* (L. 6729), *Honer* (L. 5433), *Hunton-Kirkland* (T. 16621), *Ontario-Kirkland* (L. 2678, L.2679), and the *Black* (L. 2728). Of these the Ontario-Kirkland is at present the most promising. Ore of a good grade has been developed in a greywacké schist to a depth of 450-feet; a 100-ton mill has been constructed and began production in January, 1922. The *Comfort-Kirkland* is cross-cutting on L. 1329, with the hope of getting the extensions of the Ontario-Kirkland veins. On the Kirkland *Combined* (L. 6526, L. 6572,) a 200-foot shaft has been sunk on a fractured zone.

Lebel Township.[1]—Deposits are being explored in Lebel township, 5 miles east of Kirkland Lake. These deposits include the *Bidgood* (L. 6796, etc.), where an ore shoot has been encountered in porphyry on the 300-feet level; the *King-Kirkland* (L. 4118, L. 8002, etc), which has drifted on a short ore shoot on the 100-foot level; and the *Lebel Oro,* which has a shaft on a narrow rich vein.

Goodfish Lake.[2]—At Goodfish lake, three miles north of Kirkland lake several prospects, comprising narrow lenticular quartz veins and replacement deposits, have been located along the contact of Keewatin basic volcanic rocks and schistose quartz feldspar-porphyry. The porphyry has had some influnce on the gold deposition, and appears to be Keewatin or Laurentian in age. The main exploration is on *La Belle Kirkland,* claim L. 1751, where shaft A. is 340 feet deep with levels at 100, 270, and 340 feet. On the second level there are 1,100 feet of drifting and cross-cutting. Much diamond-drilling has also been done. High-grade lenses of silicified basalt up to one foot in width have been found in a zone of low grade material 7 to 10 feet in width. The *Fidelity* (L. 2845) has a 140 foot shaft on a deposit from 2 to 7 feet in width. Much work has been done on several other gold deposits, namely, *Costello* (L. 2194, L. 2202), Martin (L. 2233), and *Brennan* (L. 2603).

Swastika[3].—Although claims were first staked for gold at Swastika as early as 1906, there was little activity until 1910, when a rich showing of gold was found on the Lucky Cross and Swastika properties. The gold occurs in shoots with pyrite

[1] Ont. Bur. Mines, Vol. XXIX, 1920, Pt. 4, 1920, pp. 46-48, by A. G. Burrows and P. E. Hopkins.

[2] Ont. Bur. Mines, Vol. XXIII, 1914, Pt. 2, p. 31; Ibid, Vol. XXV, 1916, Pt. 1 pp. 260-263; Ibid, Vol. XXIX, 1920, Pt. 4, pp. 20, 46, by A. G. Burrows and P. E. Hopkins.

[3] Ont. Bur. Mines, Vol. XXI, 1912, Pt. 2, pp. 256-265, by E. L. Bruce; Ibid, Vol. XXIII, Pt. 2, 1914, p. 20, by A. G. Burrows and P. E. Hopkins.

in lenticular quartz veins and lode deposits, 7 to 10 feet wide, in Keewatin greenstone, near the contact with Algoman red feldspar-porphyry dikes. The *Swastika* mine (R.S.C. 204, and part of lot 9, concession VI, Otto township) has a 3-compartment shaft 400 feet deep with considerable work on the 35, 100, 200, 300, and 400-foot levels. Some gold was extracted in a 10-stamp mill, the ore coming largely from two small shoots. The deposits on the *Lucky Cross* or *Marigold* (T.C. 57, 58), are of the lode type. Gold ore from the 200-foot level has been milled in the 5-stamp mill. The *Baldwin* (lot 2, concession VI, Eby township,) has a 200-foot shaft on a vein in Timiskamian conglomerate, and porphyry.

Bourkes and Sesekinika [1]

Bourkes.—Gold was found on the *Bourkes* claim, formerly the Anderson farm, (S. ½ lot 9, concession II, Benoit township), in 1916, and is described by A. G. Burrows[2] as follows:

> The deposit has the character of a shear zone in which there are lenses of quartz along its strike; at one point this rusty zone is about three feet wide. Some of the quartz lenses are about a foot in width. The rocks accompanying the quartz are greatly impregnated with iron pyrites, which on the surface is very much oxidized; calcite is also abundant in the rocks. Some specimens of oxidized material showing coarse gold also contain a dark grey mineral with metallic lustre, which proved on testing to be a telluride of gold and silver with 26.88 per cent. of gold, the mineral being probably petzite.

A shaft has been sunk 400 feet and considerable work done on four levels; approximately $20,000 of ore has been blocked out.

Gold has also been found farther east in a quartz and porphyry mass having a pegmatitic appearance, on the *Wickstead claim,* (N.W. ¼ of the N. ½ of lot 4, concession I, Benoit township) and on the *Malouf* claim (N.W. ¼ of the N. ½ of lot 10, concession II, Maisonville township). Gold occurs in a number of flat-lying quartz veins in Keewatin basic lava on the *Skognshi*[3] (N.W. ¼ of the N. ½ of lot 2, concession I, Benoit township). The *Murray-Mogridge,* formerly the Dane Copper Mining Company, has sunk a shaft 226 feet deep on a quartz and pyrite gold-bearing vein in Keewatin amygdaloidal basalt schist on lot 5, concession V, Maisonville township. On the same lot gold occurs in quartz veinlets in Algoman feldspar-porphyry. Narrow quartz veins carrying native gold and telluride of gold and silver were found in 1914, on the *Labine-Smith* claims on lot 9, concession II, Maisonville township. Quartz veins containing gold and tellurides also occur on the *Stitt* claims in central Grenfell township. The *Golden Summit* or *Sesekinika* property (lot 6, concession I, Maisonville township), was discovered in September, 1916. A 20-foot pit has been sunk on a 6-inch quartz vein carrying pyrite and some native gold in Keewatin basalt.

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[1] Maisonville, Grenfell and Eby. Ont. Bur. Mines, Vol. XXIII, 1914, Pt. 2, pp. 33-35, by A. G. Burrows and P. E. Hopkins; Gold-bearing Veins in Benoit Township, Ibid, Vol. XXVI, 1917, pp. 248-251, by A. G. Burrows.

[2] Ibid. p. 250.

[3] Ont. Bur. Min., Vol. XXVI, 1917, p. 281.

Munro Township and Vicinity [1]

Prospecting has been going on in and around the southwest corner of Munro township since 1908, when gold was first found in the area. A 9-mile wagon road connects the area with Matheson station. The early mining was on narrow quartz veins, carrying gold, pyrite, galena and molybdenite in Timiskamian sediments occasionally cut by Algoman porphyry. Small production came from the *Detroit-New Ontario* (southwest quarter, south half, lot 10, Concesson I, Munro township), *Gold Pyramid*, (part of lot 11, concession VI, Guibord township), and the *Munro* or *Guelph* in the south-east corner of lot 11, concession I. Munro township. In 1918, gold accompanied by pyrite, copper pyrites, pyrrhotite and galena was found on the *Quinn* veteran lot (north half of lot 1, concession IV, Hislop township), in a narrow quartz vein cutting porphyry or rhyolite and basalt. The most important deposit was the *Croesus* (north half, lot 10, concession I, Munro township), which was discovered in 1914, and up to the time operations ceased in February, 1918, had produced 12,470 ounces or $259,953 in gold in a 50-ton Hardinge ball mill with amalgamation plates. The ore was probably the richest ever mined in Ontario; large pieces of milky white quartz contained over 20 per cent gold by weight. A shaft was sunk 400 feet in depth, with levels at each 100 feet, on a lenticular quartz vein dipping 22° east in Keewatin greenstone. The vein cuts across alternating flows of Keewatin basalt and diabase. Other properties in the area are the *American Eagle* and *Burton-Munro*. During 1921, Messrs. Barlow and Falkenham of Matheson, discovered a spectacular gold showing on the claim directly north of the Croesus.

Painkiller Lake [2]

In 1907, gold was found at Painkiller lake, which lies 10 miles by wagon road from Matheson. The majority of the deposits are small fissure veins of the gold-telluride-quartz type carrying gold, bismuth, telluride, pyrite, chalcopyrite, pyrrhotite, galena, zinc blende, quartz, chlorite, sericite and calcite. Another type of vein containing much mispickel, pyrite and quartz and carrying low contents of gold, silver, and copper, can be seen on the *Mayot* (lot 9, concession VI, Beatty township), and *Dunlop* (in lot 8, concession V, Beatty township). These deposits resemble the gold mispickel bodies at Timagami. The rocks are Keewatin pillow lavas intruded by Algoman porphyries, which bear some relation to the origin of the deposits. The *Hill* in lot 11, concession V, Beatty township, put a trial sample through its 50-ton Hardinge ball mill which yielded gold valued at $635. The property is now operated by the *Premier Gold Mining and Exploration Company*. The *Hattie* (lots 6 and 7, concession I, Coulson township), encountered some rich showings during shaft-sinking in 1921. *Cartwright* and *La Santa Lucia* have been united under one company called *Blue Quartz Gold Mines Limited:* some diamond drilling was done in 1921. Other properties in Beatty township are the *McMaster* (in lot 9, concession V), and *Painkiller* (lot 7, concession VI).

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[1] Geological Map No. 21c Munro and Guibord by A. G. Burrows, Ont. Bur. Mines, Vol. XXI, 1912; Beatty-Munro Gold Area, by P. E. Hopkins, Ibid, Vol. XXIV, 1915, pp. 171-184; Abitibi-Night Hawk Gold Area, by C. W. Knight, A. G. Burrows, P. E. Hopkins and A. L. Parsons, Vol. XXVIII, Pt. 2, 1919, pp. 53-56.

[2] Beatty-Munro Gold Area, by P. E. Hopkins, Ont. Bur. Mines, Vol. XXIV, 1915, pp. 171-184; Abitibi-Night Hawk Gold Area, by C. W. Knight, A. G. Burrows, P. E. Hopkins and A. L. Parsons, Ibid, Vol. XXVIII, 1919, Pt. 2, pp. 56-61.

Rickard Township [1]

In July, 1917, gold was found on the *Raly* claim in the southwest quarter of the south half of lot 7, concession IV, Rickard township. During the following year considerable work, namely, 2,000 feet of diamond drilling and 700 feet of drifting on the 100-foot level, was done, which showed only one small shoot of ore, 39 feet in depth. Pyrite, chalcopyrite, galena, and molybdenite occur in all parts of the quartz vein while coarse gold, bismuth and tellurides occurred in the small ore shoot. The rock consists of Keewatin basalt with subordinate amounts of banded chert, which are intruded by Algoman feldspar porphyry. The wall rocks adjacent to the vein are replaced by calcite.

Lightning River [2]

In August, 1917, gold was found on the *Howey-Cochenour* claim L. 7315, in Holloway township. According to A. G. Burrows, and C. W. Knight, the rocks comprise alternating flows of Keewatin basalt and rhyolite lying in a nearly vertical position. The rhyolite in many parts of the area shows the presence of gold in small quantities. The original discovery is a sheeted zone from 2 to 3 feet wide, in which is a persistent quartz vein up to 10 or 12 inches wide containing calcite, chlorite, feldspar, pyrite, zinc blende, galena and visible gold. A 70-foot incline shaft was put down on the vein, but values lowered considerably when the vein passed from the more basic rock into rhyolite. Other important discoveries were made in the area during 1921.

Abitibi Lake

In 1906, there was a rush to this area, and a large number of claims were staked along the shore of the lake and on the islands. Several gold-bearing veins were found in the Keewatin schist and dolomite, Haileyburian (?) diabase and Algoman (?) granite and porphyries. These have been described by W. G. Miller[3], M. B. Baker[4] and others [5]. None of the deposits appear to be of economic value. The principal showing, that on *Shaft* or *Gold Island*, is a narrow quartz vein carrying iron and copper pyrites and zinc blende in a diabase which is regarded by A. G. Burrows, and C. W. Knight, as pre-Algoman (Haileyburian?) in age.

Patten River [6]

North of Lake Abitibi narrow auriferous veins occur in an altered quartz gabbro (Haileyburian?) near the mouth of the Patten (Woman) river and two miles west of mileage CXXV, interprovincial boundary between Ontario and Quebec.

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[1] Ont. Bur. Mines, Vol. XXVII, 1918, pp. 212-214; Ibid, Vol. XXVIII, Pt. 2, 1919, pp. 61-62; Can. Min. Journal, February 15th, 1918, p. 57.

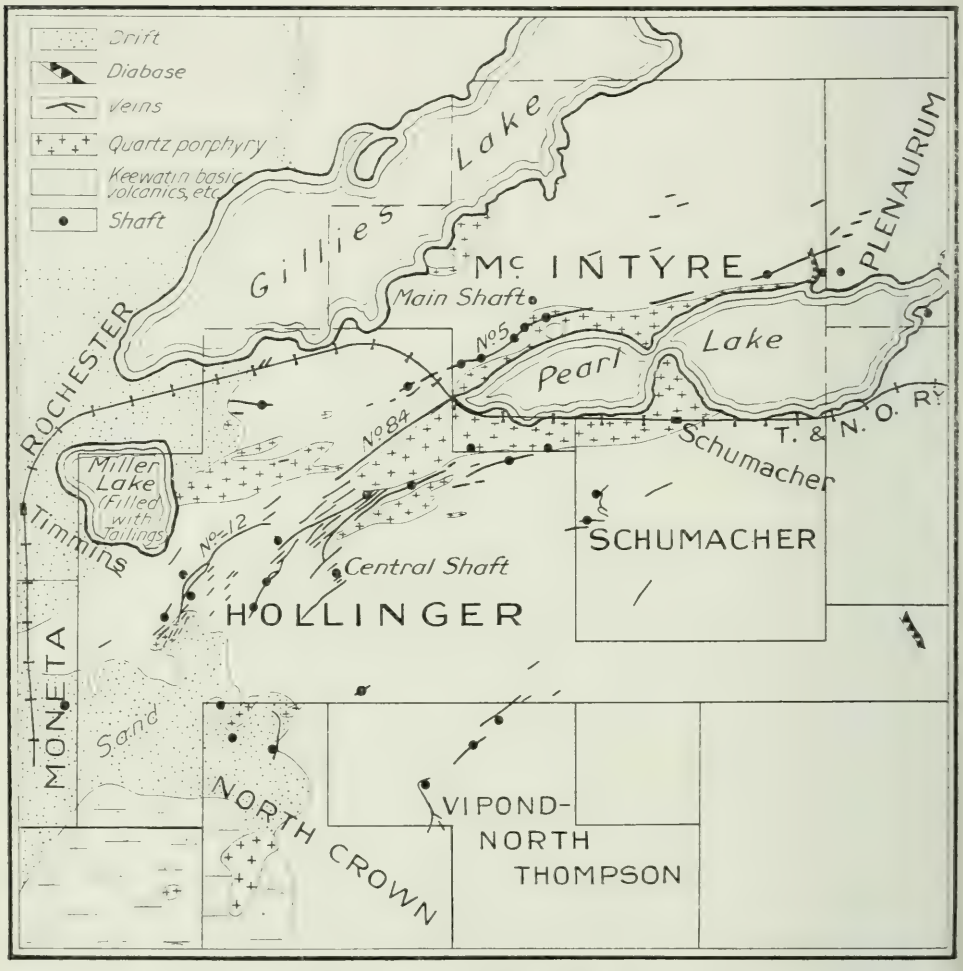
[2] Abitibi-Night Hawk Gold Area, Ont. Bur. Mines, Vol. XXVIII, 1919, Pt. 2.

[3] Ont. Bur. Mines, Vol. XVI, 1907, Pt. 1, 219-220.

[4] Ibid, Vol. XVIII, 1909, pp. 263-283.

[5] Ibid, Vol. XXVII, p. 209; Vol. XXVIII, Pt. 2, p. 52.

[6] Ont. Bur. Mines, Vol. XXVII, Pt. 1, 1918, pp. 209-210, by P. E. Hopkins.



HOLLINGER-Mc INTYRE GOLD AREA

Scale of Feet

2000 1000 0 2000 4000

Porcupine and Vicinity [1]

This is by far the most important gold area in Ontario. The first reported gold discovery was made in 1908, in quartz and schist on the *Hunter* claim on the east side of Porcupine lake. The discovery that caused a rush to the area was made by J. S. Wilson, in 1909, on the claim that came to be known as the *Dome* mine. During the following two years several mills were erected and production began. Up to the end of 1920, the total production from Porcupine was valued at $64,737,349. During 1920, the output was $10,597,572; in 1921, it was $13,095,630 in gold and $73,671 in silver. The three principal mines are the Hollinger Consolidated and McIntyre-Porcupine near the town of Timmins, and the Dome, three miles to the south-east. The ore deposits occur in Keewatin basic volcanic schists in the Hollinger area, and in the Keewatin volcanics and Timiskamian greywacke-conglomerate at the Dome; in both cases they are near the contact of schistose quartz porphyry which is classified as pre-Algoman in age. According to A. G. Burrows, the Ontario Department of Mines' geologist who studied the ore deposits, the intrusions of quartz porphyry in different parts of Tisdale township, have in some way influenced the deposition or location of the gold, but it is not likely that the porphyry has been the source of the gold-bearing solutions. [2] W. G. Miller, regards the quartz veins as genetically related to the Algoman granites and associated rocks of the region [3].

The ore deposits are of large size, low to medium in grade, and of the lode type in structure, containing much mineralized schist, metasomatically replaced. Iron pyrites is the most abundant sulphide, copper pyrites, galena and zinc blende usually occurring in the richer parts. Pyrrhotite is quite common at the Dome. Other minerals associated with the schist and quartz gangue are calcite, dolomite, scheelite, tourmaline, graphite, feldspar,chlorite, sericite, etc. The value of the ore has not decreased in depth. Number 5 vein on the McIntyre has an ore shoot 1,500 feet in length; the same ore shoot continues for at least 100 feet on Hollinger ground. No. 1 vein on the Hollinger averages 10 feet wide in ore for a length of 1,000 feet. The No. 84 ore zone on the Hollinger is 900 feet long with a lean place in the centre. Many shoots are 500 feet in length. Much thrust faulting has been encountered, e.g., in the upper levels of the McIntyre No. 5 vein, and on the Porcupine Crown vein.

Following are brief descriptions of the ore deposits and of the various types of gold occurrences: these are partly summarized from Mr. Burrows' reports. Reference should be made to the maps accompanying these reports for the geology and locations of the several deposits. Many unimportant gold discoveries have been made in almost every township in the vicinity, but these are too numerous to enumerate; however, the several types will be mentioned. Production figures for the mines mentioned hereunder are complete up to the end of 1921.[4]

Hollinger.—The Hollinger Consolidated, the greatest gold mine in Canada, comprises 400 acres in the vicinity of the town of Timmins in Tisdale township. All the rocks are schistose, consisting of Keewatin ellipsoidal basalt and dacite intruded by wedge-shaped, chonolithic masses of quartz porphyry. The apex of the main, canoe-shaped mass of quartz porphyry around which the ore bodies

[1] Porcupine Gold Area, by A. G. Burrows, Ont. Bur. Mines, Vol. XX, Pt. 2, 1911, pp. 1-39; Ibid, Vol. XXI, 1912, Pt. 1, pp. 205-249; Ibid, Vol. XXIV, 1915, Pt. 3, 1-57.
[2] Ibid, Vol. XXIV, 1915, Pt. 3, p. 25.
[3] Ibid, Vol. XX, 1911, notes accompanying map.
[4] Values do not include the exchange premium.

occur recedes or dips about 50° to the northeast. In the grey schist surrounding the quartz porphyry mass, are numerous, large, closely-spaced parallel veins or lodes consisting of quartz and mineralized grey schist. Some of the veins extend into the porphyry, but the gold values in the veins in the porphyry are either low or erratic. The veins cut the schist at a low angle and appear as overlapping lenses, many of which are connected by branch veins forming, on the whole, large lode deposits. The southerly veins dip 87° to the southeast, while the big No. 84 vein on the north side of the porphyry dips 85° to the northwest.

Underground workings total 40 to 45 miles, the deepest level being 1,530 feet. In 1920, sinking, drifting, cross-cutting and raising amounted to 18,103 feet. An electric haulage system is used on the main levels underground.

No. 4 vein on 425-foot level, Hollinger Mine, Porcupine, showing the lode structure. (Ont. Bur. Mines, Vol. XXIV, Pt. 3, p. 38).

During the latter part of 1921 the mill treated approximately 3,900 tons of $8.00 ore daily. The total production and dividends paid to the end of 1921, were $41,193,925 and $16,558,000 respectively. In the annual report of the Hollinger for the year ending December 31st, 1921, the developed ore is given as 3,402,609 tons, valued at $36,644,154. During 1922 the management hopes to attain a largely increased production from a lower grade of ore.

McIntyre.—The main quartz porphyry mass and veins Nos. 64, 84 and 91, of the Hollinger extend northeasterly on to the *McIntyre* (which has taken over the *Pearl Lake* and *Jupiter* mines); these vein extensions on the latter property are known as Nos. 1, 7, and 5 respectively. The No. 5 fissure vein, which dips highly to the northwest, has an extremely long ore shoot (1,500 feet), which rakes

steeply to the northeast. Much graphite is present in parts of the deposit. Vein No. 7, which lies a short distance south of No. 5, has been opened up for a considerable length on the lower levels. Vein No. 1, on the south side of the porphyry, was also an important deposit. Owing to the porphyry mass being somewhat wedge-shaped, more green schists and additional ore bodies are being encountered on the lower levels. In all about 63,000 feet of work has been done. The mill treats about 600 tons of $11.00 ore per day. It is the intention to enlarge the mill to a capacity of 800 tons daily. The total production to the end of 1921, was $11,857,382 in gold and $104,197 in silver. Dividends paid up to the end of 1921, amounted to $2,540,698. Developed ore reserves are valued at approximately 5½ million dollars.

Dome.—The Dome Mines, with which is incorporated the Dome Extension, comprise 400 acres in Tisdale township lying three miles southeast of the Hollinger and McIntyre. The ore bodies are less regular than the Hollinger, occurring in Keewatin basalt and the Timiskamian greywacké, and largely on the northerly edge of a schistose quartz porphyry mass. Some ore comprises well mineralized schist with numerous rich quartz veinlets. The veins strike a little north of east and dip nearly vertically, forming a large low grade, egg-shaped deposit, pitching about 45° towards the Dome Extension. Large low grade deposits have been worked by means of an open pit some 250 feet in width, and 930 feet in length. Recently, smaller individual higher-grade lodes are being worked: these are 10 to 40 feet or more in width, and yielding a higher grade of ore. Pyrite, pyrrhotite and galena are the chief sulphides. Recently some tellurides have been encountered. Ore of a good grade has been developed on the deepest levels, namely, 1,300 feet. Electric motors with storage batteries are in operation on the main levels. The mill has recently been treating about 1,000 tons of $7.00 ore daily. Sufficient ore is blocked out to keep the mill running at a maximum capacity for three or four years.[1] The total production, 1912 to 1921, inclusive, has been $13,821,613 in gold and $73,919 in silver. Dividends paid to the end of 1921 were $2,391,412.

Porcupine Crown.—This mine to the end of 1920, has produced $2,863,873 from a 4 to 7-foot quartz vein which strikes north and south and dips steeply to the east on or near a porphyry-basalt contact. The property together with the two *Thompson-Krist* claims is now owned by the *North Crown* company.

Vipond North Thompson.—The veins in this mine occur in altered greenstone and have been worked to a depth of 600 feet. The production of gold and silver amounted to $808,204, largely from the *Vipond* portion.

Schumacher.—This mine from 1915 to 1918, milled 112,124 tons of ore, yielding $561,885.02 in gold, and 4,194 ounces of silver from narrow contorted, low grade veins in highly altered Keewatin schists.

Rea, or Newray, also produced a small amount, namely, $147,076, from a rich ore shoot, approximately 200 feet long, 200 feet deep and 4 feet wide.

Plenaurum, Rochester and Moncla are promising prospects in this area. During 1921 the Nipissing Mining Co., did considerable diamond drilling on the Rochester.

Dome Lake.—Small isolated ore shoots, 2 and 3 feet in width, occur on this property in an east-west shear zone or fahleband, 1,000 feet in length. The ore consists of quartz, calcite, pyrite and metasomatically replaced rock, namely, amygda-

[1] Dome Mines Company annual report for the year ending Mar. 31st, 1920.

loidal and ellipsoidal green lava. The vein has been worked to a depth of 500 feet where the deposit dips north on to the West Dome. The property which is now closed, from 1915 to 1920 inclusive, produced gold worth $320,391 and silver valued at $1,435. These shear zones continue westerly on to the *Dobie*, or *Porcupine Tisdale*, where some favourable assays have been obtained from the surface.

West Dome and Apex to the west of the Dome have an ankerite vein some 20 feet in width cut by quartz veinlets which carry gold.

Porcupine Pet, (H.R. 907), *Preston*, or *Clifton-Porcupine* (H.R. 826), and *Porcupine-Porphyry Hill* (L.O. 325), in Deloro township, have each produced a small quantity of gold from narrow quartz veins in a rather massive quartz porphyry. A little visible gold occurs in quartz veinlets in Timiskamian conglomerate on the *North Dome*.

In the north part of the area there are large east-west shear zones in Keewatin greenstone. These are impregnated with secondary carbonate, quartz, and pyrite, and contain large lenses of quartz up to several feet in width. The *Davidson* is the only one in the area of this type which has made any production, the amount to the end of 1920 being $53,914. Other similar deposits in the zone are the *Beaumont*, formerly called *North Davidson, Crown-Chartered, Armstrong-McGibbon, Bannerman, Scottish-Ontario, Mulholland* and *Hughes*. Adjoining the Hughes is the *Gold Reef*, which produced a small amount of gold from narrow rich veinlets in basalt. Further east are the *Keora*, with gold in rusty carbonate, and the *Three Nations* and *La Palme* with narrow gold-bearing quartz veins in Timiskamian conglomerate.

Gold-bearing quartz veins also occur in Timiskamian sediments on the *McAuley-Bridge* claims in Bristol township. In the same township in 1921, gold was found in a narrow quartz vein in basalt schist on the *Hendrickson* claim. There are auriferous quartz veins in dolomite or ankerite on the *Anchorite* and *Maidens-McDonald* in Deloro township, and on the *Foster* claim in Thomas township. On the Anchorite a shaft has been sunk 350 feet and some ore of a good grade developed in two veins. Banded iron formation is cut by secondary gold-bearing quartz veins on the *Wright* (R.S.C. 175, R.S.C. 176), *James* and *Philadelphia* claims in Deloro township. Gold occurs in quartz veinlets in red aplite (large low-grade stockwork deposits), on *Gold Island*,[1] *Night Hawk Lake*, and in the adjoining Keewatin green schist. Rich ore was encountered in green schist in the 180-ft. shaft and on the 80-ft. level of the *Peninsular*, Night Hawk lake.

The *Tommy Burns* or *Triplex* in the southeast part of Shaw township has produced a few hundred dollars in gold. The small quartz vein on this property contains visible gold and occurs in pillow basalt, iron formation and an intrusive porphyry. Considerable development work has also been done on the *Triumph, Success, Hollinger Reserve, Whelpdale, Hayden, Big Dyke, Porcupine Paymaster (formerly Standard), March, Holtyrex* and others.

Gold has been found in several places west of Porcupine in Keewatin rocks. At Kamiskotia lake[2], in Robb township, are masses of Haileyburian (?) gabbro and diabase which have acid phases represented by felsite and aplite. The

[1] Ont. Bur. Mines, Vol. XXIV, 1915, Pt. 3, p. 27.

[2] Idem, pp. 58-60. Kamiskotia Lake Area, by A. G. Burrows and P. E. Hopkins.

principal deposit, the *Jamieson*, three-quarters of a mile south of the lake, consists of one of these felsite dikes intersected by gold-bearing quartz veinlets and carrying iron and copper pyrites, tourmaline and calcite. The *Lally* prospect is situated about three miles from the north boundary, on the east line of Turnbull township. Two shallow shafts have been sunk on a stockwork of porphyry and quartz.

At *Cripple Creek*,[1] in Carscallen and Denton townships, gold occurs with iron pyrites in lenticular quartz veins and parallel stringers in Keewatin schist and Algoman gray granites. At the *Union* mine, Whitesides township, a 275 foot shaft has been sunk on a quartz-schist zone, 40 feet in width. Gold occurs near the south boundary of McArthur township,[2] in a network of veinlets in a quartz feldspar dike on the *Chouinard* claim and in a narrow quartz vein in felsite on the *Hull* claim.

Matachewan [3]

At Matachewan gold is found in narrow quartz veins in a boss of red Algoman syenite on the *Brookbank* claim (17801, Alma township), and on the *Chief* claim (17310 Alma township). A stockwork deposit, 150 feet in width occurs in the same syenite mass on the *Craig* claims (16227 and 16228, Cairo township). A 100-foot shaft has been sunk on a small vein occurring in the hornblende and mica granite on the *Thesaursus* (M.R. 5868, Baden township). The principal deposits in the area are on the *Davidson* (5372 and 5373), and *Matachewan Gold Mines*, (5379, 5380, formerly the *Otisse*), in Powell township. On the Davidson, according to Mr. Burrows' second report,[4] "most work was done on irregular masses of quartz in a rusty weathering greenish schist. Considerable surface work was also done on a red syenite or orthoclase porphyry intrusive, which is intersected by quartz veinlets in a more or less stockwork arrangement, with many of the veinlets roughly parallel. Some very good assays were obtained in parts of the porphyry intrusive, but no underground work has been done as yet on these claims." On the Matachewan Gold Mines, "A number of separate ore shoots were indicated by this means [trenching]. In addition to trenching, further prospecting was done by means of diamond-drilling, after which two shafts were sunk. No. 1 shaft was sunk to a depth of 170 feet vertically, and drifts were run on the 160-foot level along a mineralized contact, between the basaltic rocks and the light green calcerous rocks.. . . . Several varieties of ore have been recognized in the workings. The most prominent is a light grey rock that has been altered from a dark basaltic rock. This carries abundant iron pyrites of small grain, much carbonate of iron, lime and magnesia; secondary feldspar, some sericite, and quartz in minute veinlets. Several narrow dikes or irregular masses of red

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[1] Cripple Creek Gold Area, by W. R. Rogers and E. L. Bruce: Ont. Bur. Mines, Vol. XXI, 1912, Pt. 1, pp. 266-270.

[2] Notes on McArthur Township, by P. E. Hopkins, Idem, pp. 278-280.

[3] The Matachewan Gold Area, by A. G. Burrows, Ont. Bur. Mines, Vol. XXVII, 1918, Pt. 1, pp. 215-240; Ibid, Vol. XXIX, Pt. 3, 1920, pp. 53-64; Mem. No. 115 Geol. Surv. Canada, 1919, by H. C. Cook; Origin of the Gold Deposits of Matachewan, Econ. Geol. Vol. XIV, No. 4, 1919, by H. C. Cook. Geological maps accompany these heports.

[4] Ont. Bur. Min., Vol. XXIX, 1920, Pt. 3, pp. 57, 59, 60, 61.

or grey porphyry occur in trenches to the west of No. 1 shaft. They intrude the light-greenish carbonate schist, and these, particularly the grey varieties, frequently carry high gold values. They are so irregular that it is impossible to connect outcrops revealed in trenches only twenty feet apart. The schist along the porphyry intrusion usually carries gold values, where there are quartz stringers and an impregnation with iron pyrites." Iron pyrites, copper pyrites, and scheelite are present in the ore.

Gold has been found on the *Robb* claim (5402) and *Lake Matachewan Gold Mines* (5531 and 5514), in Powell township. During the fall of 1921, gold bearing quartz in porphyry was discovered in a small Keewatin area in the vicinity of George lake in Holmes and Flavelle townships. In 1921, B. Mickmac, an Indian, discovered a spectacular gold showing in conglomerate (?) schist in the north central part of Rankin township.

Gold-bearing quartz veinlets in syenite porphyry on the Davidson property, Matachewan area. (Ont. Bur. Mines, Vol. XXIX, Pt. 3, p. 56).

A hydro-electric development at Indian Chute on the Montreal river is projected to serve the power needs of this area.

West Shiningtree [1]

Since the first discovery of gold in 1911, when the railway was 60 miles distant, numerous other finds have been made in parts of four townships. The railway now passes within 20 miles, and is connected by a wagon road with most of the properties. No gold has yet been produced apart from what may have come from a few high-grade samples. The encouraging results obtained on a few properties, e.g., the *Wasapika*, *Herrick*, *Buckingham*, and *Gosselin*, may lead to min-

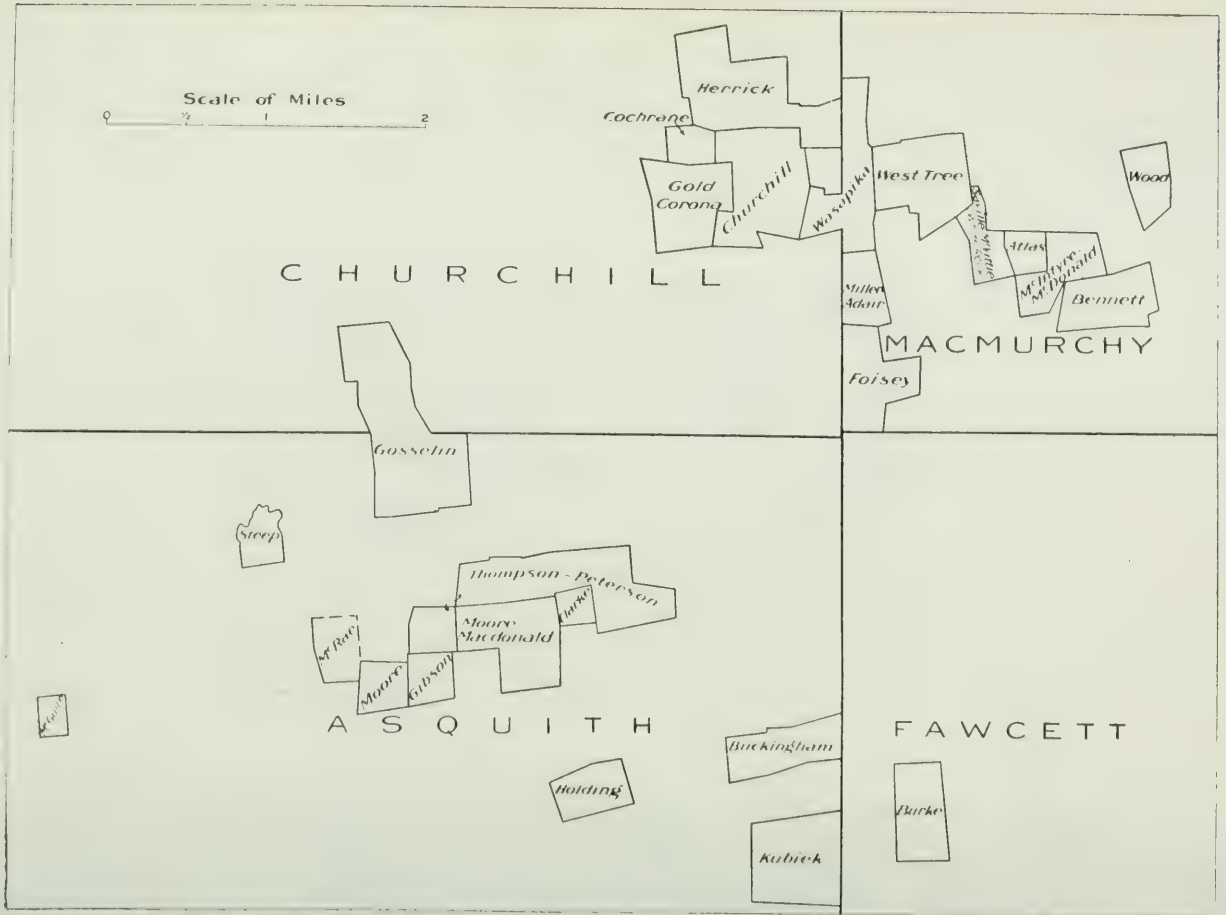
[1] West Shiningtree Gold District, by R. B. Stewart. Ont. Bur. Mines, Vol. XXI, 1912, Pt. 1, pp. 271-276; West Shiningtree Gold District, Ibid. Vol. XXII, 1913, pp. 233-237; West Shiningtree Gold Area, by P. E. Hopkins, Vol. XXIX, 1920, Pt. 3, pp. 28-52; Mem. No. 95, Onaping Map-Area between Shiningtree and Onaping Lakes, Geol. Sur. Can., by W. H. Collins.

ing being done on a larger scale. The "Ribble" vein which occurs in a chloritic schist extends southerly on the *Miller-Adair*. It is half a mile or more in length and averages at least four feet in width. A cross-cut on the 100-foot level of the *Wasapika* or *Ribble Mines* showed 23 feet of schist and quartz. At the 200-foot level the deposit is reported to be of a nearly similar width. Visible gold was seen by the writer on the 100-foot level and in some parts of the vein outcrop.

Gold-bearing quartz veins of the area have been found in Keewatin and Algoman rocks. They occur largely in the old basic volcanics, as in the case of the "Ribble" vein on the *Wasapika*. A vein carrying gold on the *Churchill* property passes from altered basalt into a rhyolite or porphyry. Gold occurs in quartz cutting iron formation on the *Cochrane* and *Gold Corona*. The *Herrick* vein passes from conglomerate and slate into mica lamprophyre, and has been exploited

Gold-quartz deposit outcropping on the Atlas property, West Shiningtree area.

on the 100-foot level. Coarse gold was seen on the *Clark* claim in quartz stringers, which cut rusty-weathering green magnesium-iron-calcium carbonate. On the *Gosselin*, the gold and quartz occur partly in the porphyry and felsite or rhyolite. Spectacular showings in a nearly transparent quartz on the *Holding* claim are entirely in amphibolite or hornblende schist. Most of the deposits in the vicinity of the *Steep* on West Shiningtree lake, and easterly to the *Buckingham*, occur in bluish grey quartz veins and lenses in shear zones in altered basalt, andesite and rhyolite. There is another type of deposit comprising banded tuff with pyrite or alternating layers of slate and pyrite, resembling iron formation, and carrying only small quantities, e.g., the *Moore*. The deposits on the *West Tree*, *Saville (White Rock)*, *Atlas*, *McIntyre-McDonald* and *Bennett*, are of the lode type in Keewatin schist. The gold which occurs native and at times contains small quantities of silver, is found in dark seams in the fractured quartz with calcite, sericite talc, chlorite and pyrite. Such minerals as chalcopyrite, molybdenite,



Map showing location of various properties in the West Shiningtree area. (Ont. Bur Mines, Vol. XXIX, Pt. 3, p. 38).

pyrrhotite, barite, galena, tourmaline and specular hematite are present in certain deposits. Pyrite is usually abundant in the wall rock, but on the whole, is scantily distributed in the quartz. Most of the deposits are cut by Keweenawan diabase dikes, usually without being displaced.

Penhorwood and Reeve Townships

"Gold occurs in quartz veins cutting a ferruginous dolomite and chlorite schist—1½ miles north from the northeast corner of Penhorwood township [near Tionaga station]. No free gold is visible, but a sample taken across a vein by the writer yielded upon assay 0.02 ounces to the ton."[1] During 1921, F. Gosselin stated to the writer that he found visible gold in Penhorwood and Reeve townships, 8 miles north of Groundhog station. Considerable work was done on these deposits during 1921.

North of Lake Superior

Gold has been produced at the Empress Mine near Jackfish station, and trial shipments have been made from properties near Schreiber and Big Duck Lake.[2] These deposits occur in Keewatin schists near Algoman granite or porphyry. Veins carrying gold occur farther north along the Canadian Northern railway near Jellicoe and Kinghorn stations and Little Long Lake, and also on the Canadian National railway near Kowkash and Tashota.

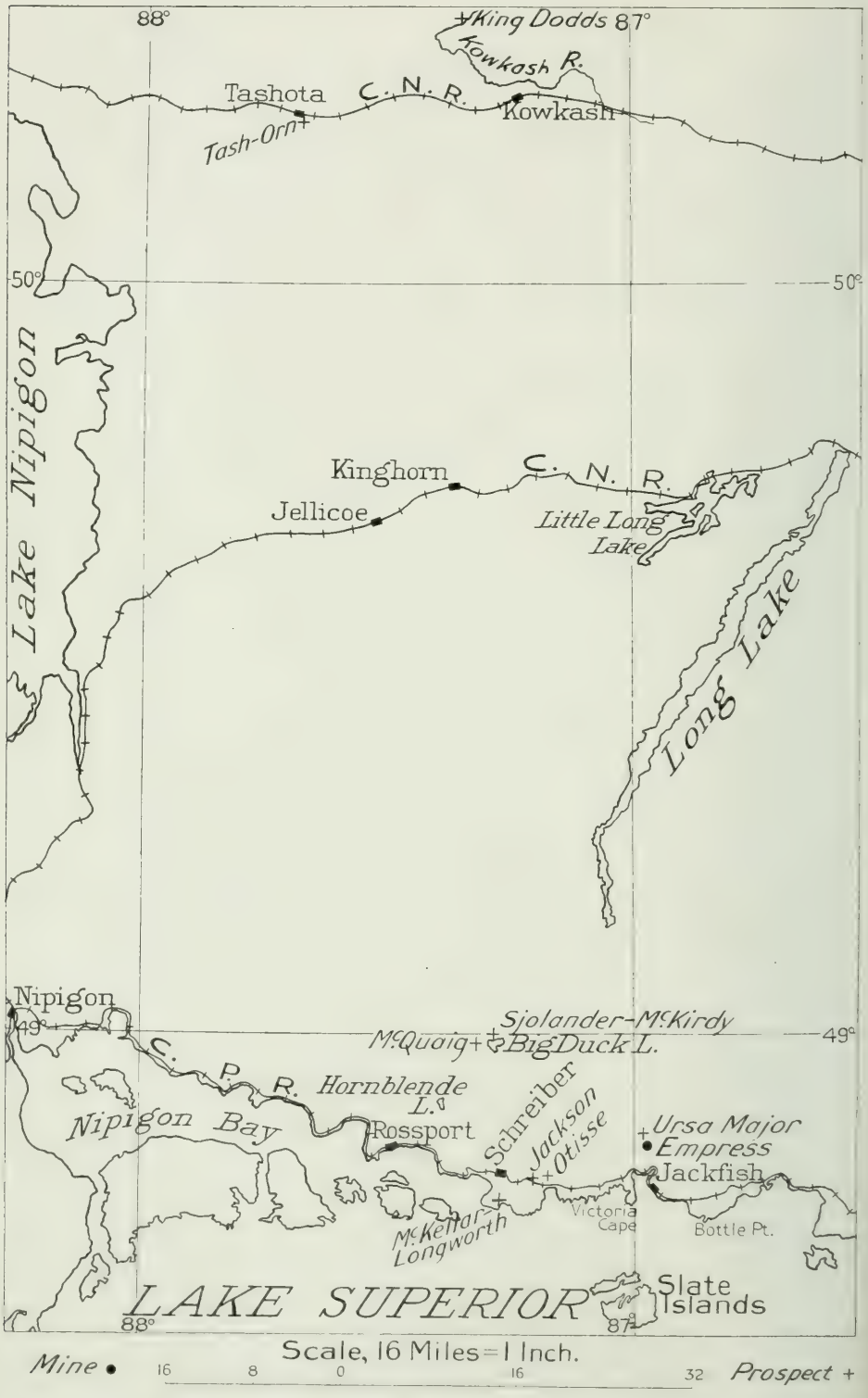
On the *Empress* claim, R. 569, is a large low-grade lode deposit in hornblende schist carrying much pyrite and some chalcopyrite, zinc blende and galena. A 10-stamp mill produced some bullion between 1896, and 1899, the ore coming largely from tunnel workings. Gold has been found in the vicinity on the *Ursa Major, Victoria Cape, Slate Islands*[3] and *Bottle Point*.

Some veins in the vicinity of Schreiber on the *McKellar-Longworth* (B. J. 122), *Jackson* (T. B. 3326, 3354), and *Otisse* (T. B. 3412), are narrow and contain rich showings of gold. During 1921, much exploratory work was done on the Jackson and McKellar. On the latter claim gold-telluride-quartz deposits have been found at intervals for half a mile in a pronounced east-west shear zone.

At *Duck* lake, the two principal properties, the *McQuaig* or *Beaver* (T.B. 1686), and the *Sjolander-McKirdy* (T.B. 1861), are largely replacement deposits in which the gangue mineral is nearly all calcite, with considerable included schist and only a few quartz veinlets. Considerable gold in a fine flour state can be seen accompanied with pyrite, chalcopyrite, galena and zinc blende. A 45-foot shaft has been sunk on the McQuaig vein which passes from quartz porphyry into chlorite schist.

In the vicinity of *Jellicoe* and *Kinghorn* stations, and *Little Long* Lake, A. G. Burrows has obtained low gold values in gold from quartz veins in Keewatin pillow lavas intruded by an occasional felsite or albite porphyry dike. "A three-inch stringer containing quartz, specular iron ore, copper pyrites and iron pyrites, from a rock cut at mileage 145, near *Kinghorn*, gave on assay $1.20 in gold per ton. In a rock cut one mile to the west of Jellicoe there are several lenticular masses of quartz in the basalt. One of these, 15 inches in width, gave on assay $4.00 per ton. Gold values up to $2.00 per ton, were obtained from specimens of quartz, schist and iron pyrites from the shores of the west arm of Little Long Lake.[4] In the same area, "on the *Edie* claim near Main narrows, Little Long

[1] Sum. Rep. Geol. Sur. Can., 1916, p. 181, with map, by T. L. Tanton.
[2] Gold at Big Duck Lake, Ont. Bur. Mines, Vol. XXIV, 1915, Pt. 1, pp. 9-13, Schreiber-Duck Lake area, by P. E. Hopkins, Ont. Bur. Mines, Vol. XXX, 1921,
[3] Ont. Bur. Mines, Vol. XXVII, 1918, Pt. 1, pp. 155-167, by A. L. Parsons.
[4] Longuelac to Jellicoe and Orient Bay, by A. G. Burrows, Ont. Bur. Mines, Vol. XXVI 1917, p. 244



Map showing location of gold areas north of Lake Superior along the lines of

lake, gold occurs in angular fragments of quartz, up to 3 inches in diameter in the drift along the shore."[1] T. Devanney has done considerable work on the Jellicoe deposits.

Kowkash-Tashota Area[2]

In 1915 gold was found on the *King-Dodds* claim (T.B. 2424) nine miles north of Kowkash station and in the following year on the *Tash-Orn* or *Wells* claim (T.B. 2892) near Tashota station. On the former claim there is a quartz vein up to 6 inches in width, which carries iron pyrites and rich showings of gold, and on which a 90-foot shaft was sunk. The wall rock is Keewatin pillow lava schist cut by Algoman quartz porphyry. The Tash-Orn lode deposit, which occurs in similar rocks, is 8 feet wide and contains visible gold, iron and copper pyrites, native copper and pyrrhotite. A shaft has been sunk 140 feet and some drifting done on the 90-foot level, the deposit containing approximately $5.00 in gold across 5 feet.

Gold has been discovered on the *Richardson* (T.B. 2599), *Devanney* (T.B. 2650), *Hull* (K.K. 92), *Hendrickson* (K.K. 15), and *Cline* (K.K. 61).

Sturgeon Lake Area[3]

Since gold was discovered in the area about 1894, the precious metal has been found to be widespread, occurring usually in and genetically connected with Algoman granite and other related types near the contact with Keewatin schists. Sturgeon lake, around which the deposits occur, lies four miles south of Bucke station on the Canadian National railway. According to E. S. Moore, the deposits are composed of lenses and stringers of quartz containing calcite, syenite, pyrite, chalcopyrite, galena, zinc blende, pyrrhotite and gold. Although on four properties stamp mills have been erected, only one, the St. Anthony, has produced an appreciable quantity of gold.

St. Anthony.—Claims B.G. 151, 152, formerly known as the Jack Lake and St. Anthony Reef, have been worked intermittently from 1903 to the present. The total production from the 10-stamp mill according to one owner, George Glendinning, is approximately $200,000 in gold. The deposit consists of three quartz lenses up to 25 feet in width, extending from the Keewatin into the altered granite, the vein being largely in the latter rock. The workings have reached a depth of 525 feet.

The U.S. Gold Mining Co. or Shore Properties (A.L. 367, 368; B.G. 136) have a 2-stamp mill which yielded a little gold about 1902, from small irregular quartz veins in granite near the greenstone.

Dawson.—The English River Mining Company, formerly the Sturgeon Lake Mining Company, operated the Dawson mine, B.G. 157, with a 10-stamp mill.

Belmore Bay.—A 3-stamp mill was erected on the Belmore Bay mine, S.V. 450.

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[1] Geol. Sur. Can. Summary Report, 1917, p. 4E, by T. L. Tanton.

[2] The Kowkash Gold Area, by P. E. Hopkins, Ont. Bur. Mines, Vol. XXVI, 1917, pp. 190-226.

[3] Sturgeon Lake Gold Area, by E. S. Moore; Ont. Bur. Mines, Vol. XX, 1911, Pt. 1, pp. 133-157. Geol. Sur. Can. reports by W. H. Collins, No. 992, pp. 19, 20; No. 1059, pp. 56-58.

Huronian Mine [1]

The first discovery of gold in western Ontario was made in 1871 at the Huronian mine, location H.1 in Moss township. According to A. P. Coleman's report [2] the deposit is a bedded vein from 6 to 8 feet wide, of which from 2 to 5 feet are white quartz, the rest being incorporated schists. The gold occurs free, and as sylvanite associated with galena, iron and copper pyrites, and zinc blende. The country rocks are talcose slate, chlorite schist, and altered porphyries [Keewatin]. "A small intrusive area of granite, well exposed on Jackfish Lake, sends an arm southwestward to within a short distance of the mine." [3] A 10-stamp mill was built in 1883, and was in operation for part of the following two years.

Atikokan or Upper Seine Area

In the vicinity of Atikokan station, a divisional point on the Canadian National railway, on the Upper Seine waters, are situated the Harold Lake, Elizabeth, Hammond Reef, Saw Bill and Sunbeam (A.L. 282) mines all of which have produced some gold. According to A. P. Coleman, [4] the country rock on the *Harold Lake* (219X), consists of various yellow and green schists pierced by small eruptive masses or bands of granite or protogine, the last mentioned rock being probably the source of the gold. The deposits are narrow fissure veins up to 2½ feet in width. Some of the veins occur in the granite itself, or at its contact with the schist, and others entirely in the schist. The quartz contains much pyrite, chalcopyrite, galena and in places a good deal of gold. A 5-stamp mill was operated during 1895 and 1896. The *Hammond Reef* (337X, 338X, etc.), is a large stockwork or zone of greatly shattered protogine or altered granite (Laurentian ?) in which quartz has been deposited, filling all the small fissures and cementing the rock together. The deposit is three-quarters of a mile or more in length, and 100 to 300 feet in width; it carries visible gold in some parts. In the quartz and granite are iron pyrites and occasionally a little galena, zinc blende, and magnetite. [5] A 10-stamp mill was installed in 1897, and an additional 30 stamps were added in 1899, but the mill results were disappointing. The gold-bearing material was quarried. Power was supplied by the hydro-electric plant, about two miles distant. All operations ceased on October 6th, 1900. [6] On the *Saw Bill* (313 and 314 X), is a quartz vein 4 to 6 feet wide carrying pyrite, chalcopyrite, galena and some free gold. The wall rock is foliated biotite-granite-gneiss or protogine (Laurentian ?). A 10-stamp mill was erected and commenced operation in October, 1897, but very little gold was recovered. The property has remained idle since the autumn of 1897. The workings are about 275 feet deep. The *Sunbeam*, or *A.L. 282*, has a number of short ore shoots confined to a fissure quartz vein, 4 to 5 feet wide, in altered biotite-granite-schist. An incline shaft at an angle of 43 degrees has been sunk 410 feet. Con-

[1] For the geology, see Map. No. 589, Lake Shebandowan Sheet, by W. McInnes, accompanying Annual Report of Geol. Sur. Can., Vol. X, New Series, 1897, or reprint accompanying Vol. VI, 1896, Ont. Bur. Mines.

[2] Ont. Bur. Mines, Vol. V, 1895, pp. 76, et. seq.

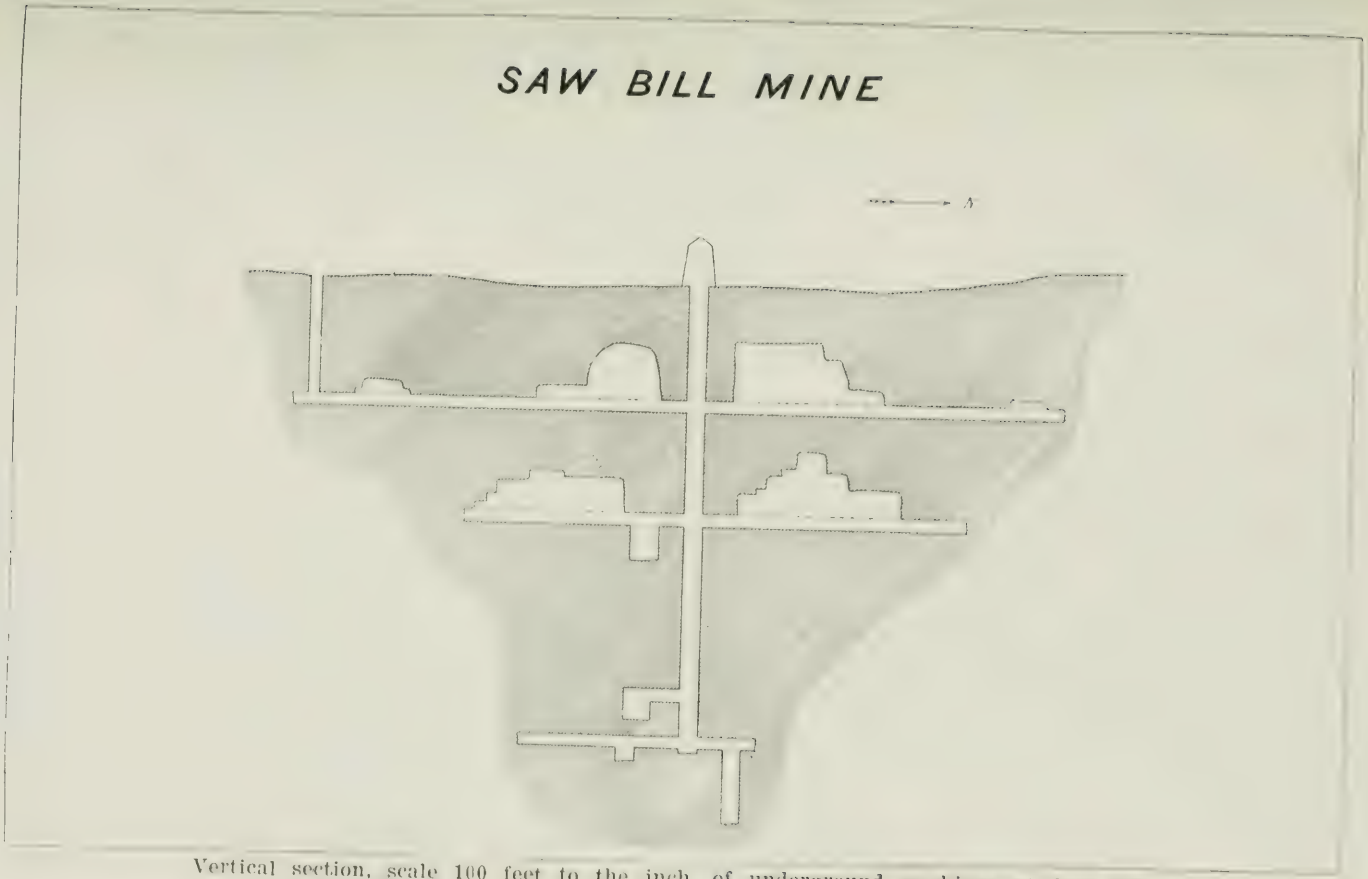
[3] Geol. Sur. Can., 1897, p. 59 H, by W. McInnes.

[4] Ont. Bur. Mines, Vol. V, 1895, pp. 69-70; Ibid, Vol. VII, Pt. 2, pp. 130-131 A. P. Coleman.

[5] Ibid, Vol. IX, 1900, pp. 77-78; Ibid, Vol. X, 1901, pp. 103-104.

[6] Ibid, Vol. VI, 1896, p. 76, A. P. Coleman.

To accompany Report by P. E. Hopkins in Vol. XXX, Part 2, Ontario Department of Mines Report, 1921



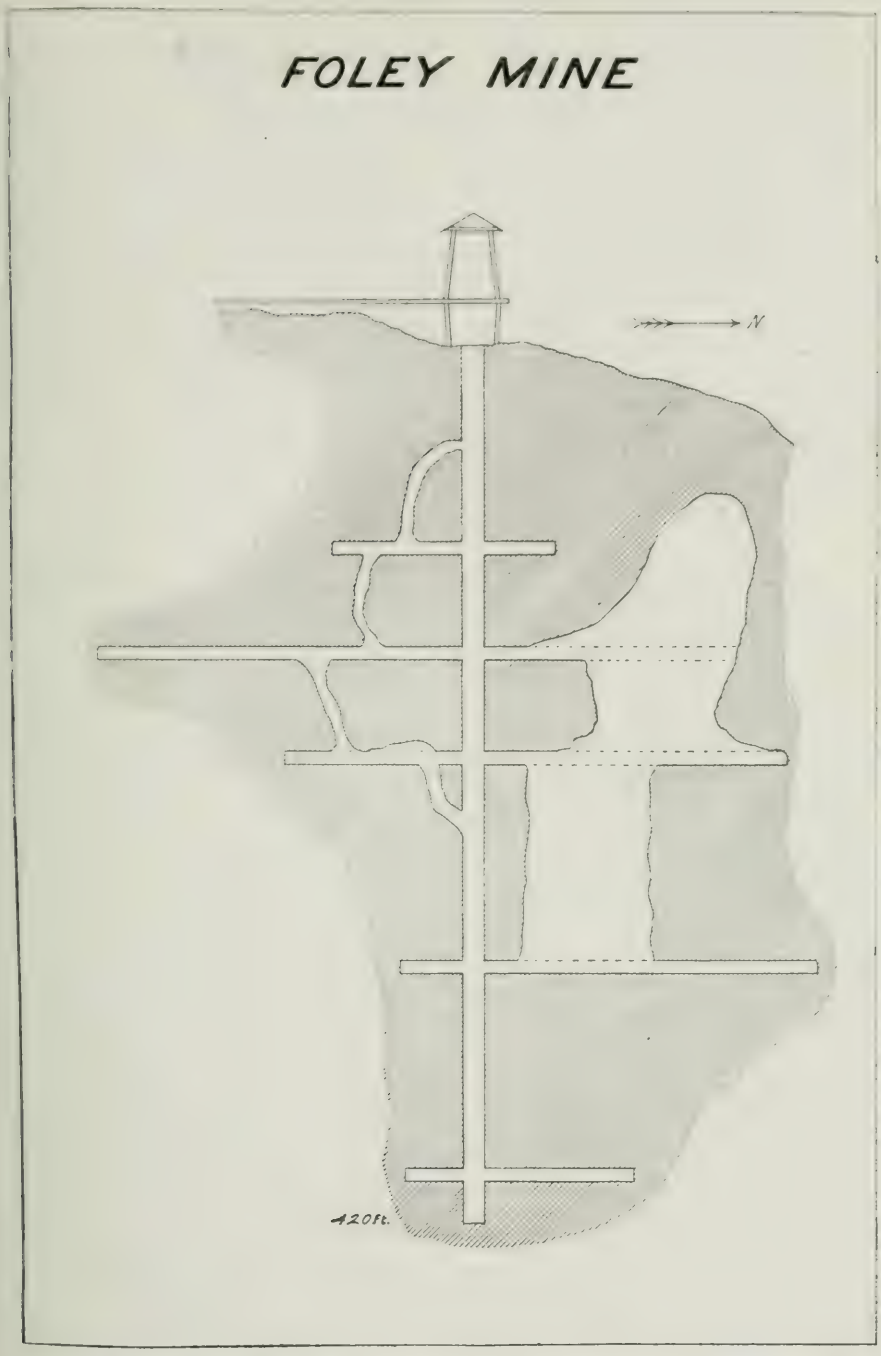
Vertical section, scale 100 feet to the inch, of underground workings at Saw Bill mine, north of Atikokan. (Ont. Bur Mines, Vol. IX p 77)

siderable gold bullion was produced from a 10-stamp mill erected in 1904, on 614Z., three-quarters of a mile distant from the ore body.[1] The mine has remained closed since the early part of 1905. The *Elizabeth* (F.M. 171, F.M. 172) was discovered in July, 1900, and before it closed, in 1903, a 10-stamp mill had been erected and some bullion produced. The deposit consists of a series of quartz lenses crossing from chloritic schists into altered granite. The quartz is white and granular, like the silica in iron formation.[2] "The lode is developed by shafts, winzes, and levels to a depth of 280 feet and the gross amount of ore exposed to date (February, 1903), was about 20,000 tons. The width of the stopes varies from 4 to 12 feet, and while there are some rich lenses and shoots of quartz in which the values rise to $40 and $50 a ton, the average value may be taken at from $8 to $10."[3] According to W. E. H. Carter, the pay shoot is 250 feet in length along the course of the vein.[4] The mine was re-opened and produced bullion during parts of 1912, 1913, and 1914.[5]

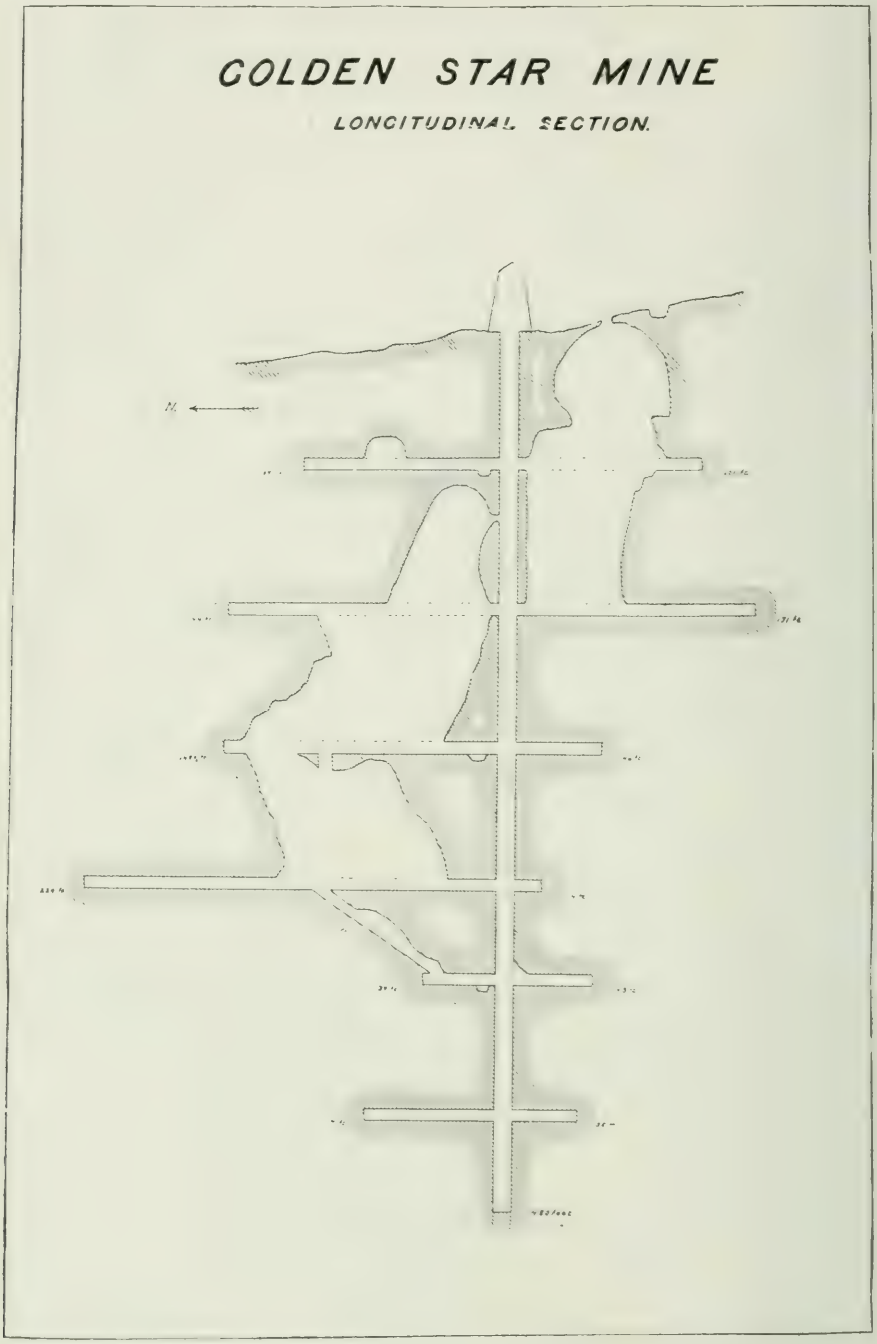
Mine Centre, East Shoal Lake or Lower Seine Area

The best geological map of the area is that accompanying A. C. Lawson's report of the Archean Geology of Rainy Lake.[6] A small portion of the sheet near Vermilion lake has been revised by A. L. Parsons.[7] Gold was first discovered in the area in 1893 on claim A.D. 2; during the following seven years approximately $250,000 in bullion was produced from the Golden Star, Foley and Olive, with small amounts from the Ferguson, Lucky Coon and Stone. The veins occur in Keewatin green schists, and in an intrusive boss of Laurentian granite. The granite, which is probably responsible for the gold, is classed as Algoman by A. L. Parsons. The *Foley* (A.L. 74,75,76), *Lucky Coon* (P. 655) and *Ferguson* (A.L. 110-112, K. 223) deposits are narrow fissure quartz veins up to a few feet in width in coarse mica-granite or protogine. In places the veins are joined by cross fractures, presenting a stockwork effect, while in other places the veins are small and difficult to trace for any appreciable length. Minerals usually present are pyrite, galena, zinc blende, copper pyrites, and visible gold. The Foley produced in the neighborhood of $75,000 prior to 1900, from above the 420-foot level. The mine was optioned by the Swedish Mining Syndicate in 1920, and the workings partially de-watered and sampled. The *Golden Star* (A.L. 114, 116, J.O. 4), the principal mine, produced $161,000 from a lenticular quartz vein in Keewatin basic schist, the shoots averaging $10.60 across 3½ feet. Underground workings were carried to a depth of 537 feet with 3,500 feet of lateral work. Operations ceased in 1900, and the plant, including a 10-stamp mill, was burned in 1910. A gold-bearing vein occurs in a similar green schist

[1] Ont. Bur. Mines, Vol. XIV, 1905, Pt. 1, p. 56.
[2] Ibid, Vol, XI, 1902, p. 150, A. P. Coleman.
[3] Ibid, Vol. XII, 1903, p. 15.
[4] Ibid, Vol. XI, 1902, p. 241.
[5] Ibid, Vol. XXII, 1913, p. 99; Ibid, Vol. XXIV, 1915, p. 95.
[6] Memoir No.. 40, Geol. Sur. Can. 1914.
[7] Map facing page 172, Ont Bur. Mines, Vol. XXVII, 1918, Pt. 1.



Vertical section, scale 90 feet to the inch, of underground workings at the Foley mine, Mine Centre. (Ont. Bur. Mines, Vol. IX, p. 65).



Vertical section, scale 105 feet=1 inch, of the workings at Golden Star mine, Mine Centre. (Ont. Bur. Mines, Vol. IX, p. 69).

on the adjoining *Stone* property A.L. 113. The *Olive* or *Preston* (G. 61), according to A. P. Coleman,[1] is on a bedded quartz vein running from 6 inches or less, to about two feet in width in a greenish-grey sericite schist or phyllite, and carrying considerable gold, pyrite, pyrrhotite, chalcopyrite, and dolomite. A. P. Coleman also refers to gold and quartz in felsite schist on *K. 190*, and *K. 191*, north of Potato lake.

Lake Manitou Area

Gold was found in this area about 1895, and the occurrences have been described by A. P. Coleman,[2] A. L. Parsons,[3] and others. The rocks are Keewatin altered diabase, diorite, andesite, agglomerate, and quartz-porphyry. According to A. P. Coleman,[4] "The deposits are of great variety, fissure veins, bedded quartz veins, schists impregnated with sulphides and dikes of porphyry, all carrying gold to a greater or less extent." A. L. Parsons, describes the deposits as light-coloured schists containing quartz, a considerable percentage of pyrite and some calcite. The following descriptions of the mines are largely from A. L. Parsons' reports:

The *Laurentian* (H.P. 371), began operations in 1903 and produced from a 20-stamp mill the greatest amount of gold from any one property in the area. The main ore body consists of diabase schist and numerous bands of quartz, from a mere trace up to several inches in width, having in all an average width of 20 feet. "The sinking has followed a small vein of dark quartz, which in places produced some showy free gold specimens."[5] The deposit has been worked to a depth of 480 feet, and ore has been stoped from small shoots on various levels and only in proximity to the shaft.[6] *The Big Master* (H.P. 366, etc.) vein, according to Mr. Parsons, shows a remarkable similarity to iron formation. A 10-stamp mill produced some bullion between 1902 and 1905. According to the mine plans, the ore shoot in the west vein has been found to widen and lengthen respectively from 2½ feet by 30 feet on the surface, to 8 feet by 156 feet on the second or 185-foot level, and 9 feet width in the winze below this point, (285-foot level), and to have shown an average value of $17 per ton. The east vein or shoot, so far only opened out along the first or 85-foot level, has a length there of 140 feet, and a width of 12 feet, with an average assay value of $8.35 per ton."[7]

The *Twentieth Century Mining Company* sank a shaft 340 feet deep on H.P. 398, and installed a 20-stamp mill which produced a small quantity of gold. The stamp mill was later removed to the Laurentian. The Company also operated the *Volcanic Reef* (S.40), which has a small quartz vein with pyrite and gold.

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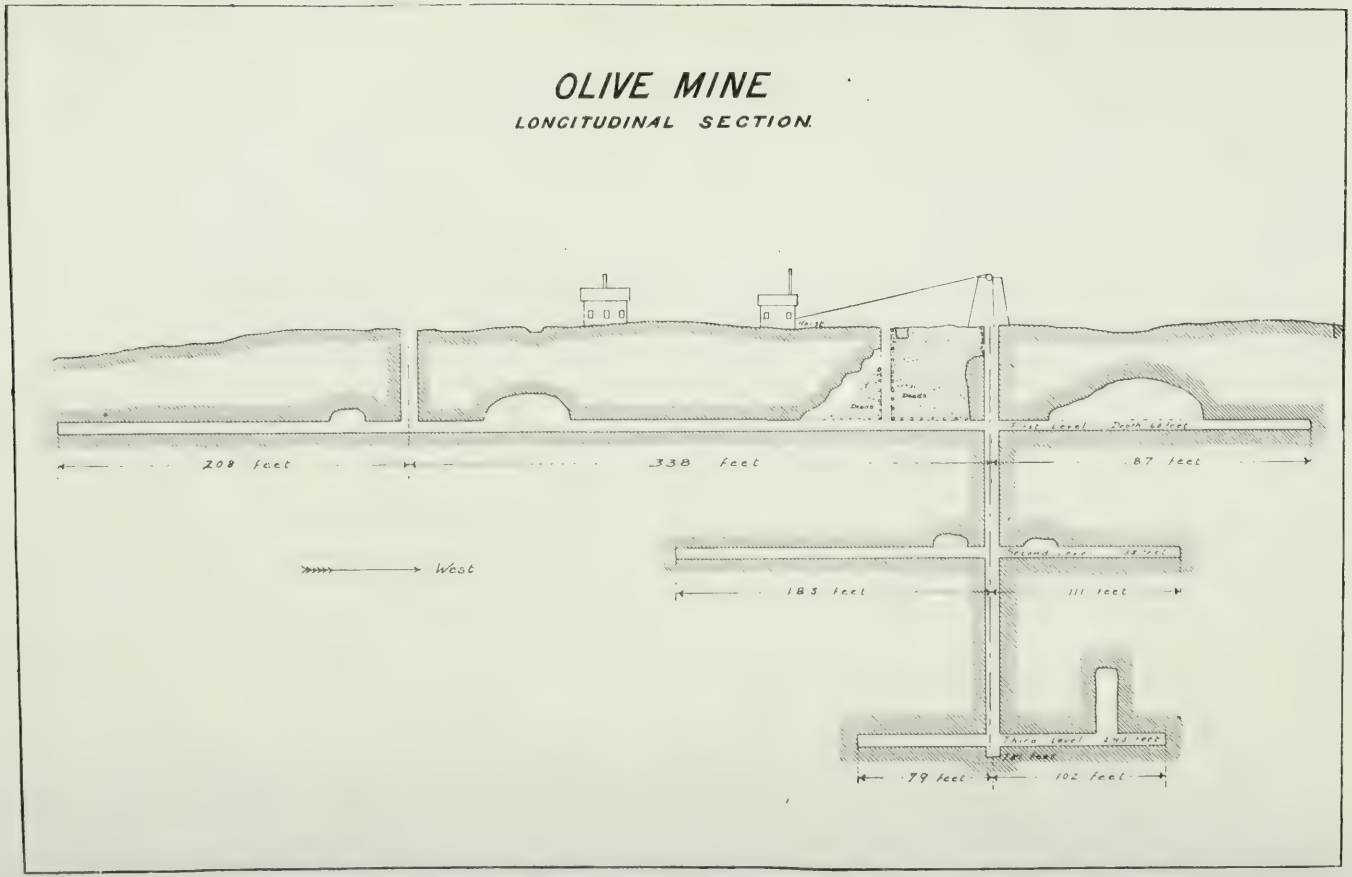
[1] Ont. Bur. Mines, Vol. VII, 187.Pt. 2, p. 128.
[2] Ont. Bur. Mines, Vol. VI, 1896, pp. 83-87; Ibid, Vol. VII, 1897, Pt. 2, pp. 121-123.
[3] Ibid, Vol. XX, 1911, Pt. 1, pp. 178-188; Ibid, Vol. XXI, 1912, Pt. 1, pp. 194-198.
[4] Ibid, Vol. VI, 1896, p. 86.
[5] Ibid, Vol. XIV, 1905, Pt. 1, p. 52, E. T. Corkill.
[6] Ibid, Vol. XVIII, 1909, p. 79, E. T. Corkill.
[7] Ibid, Vol. XIV, 1905, Pt. 54, W. E. H. Carter.



Vertical section of workings, Olive mine, Mine Centre, scale 110 ft.=1 inch. (Ont. Bur. Mines, Vol. IX, p. 73).

The *Paymaster* (H.W. 20) has a schist quartz vein in diabase which has been opened to the 325-foot level. A 10-stamp mill is on the property. Other prospects are the *Victory* (McA. 28), *Jubilee* (H.P. 301) with a 4 or 5-foot fissure vein, *Little Master* (H.P. 375), *Detola* (R.P. 411), and *Last Chance* (S. 28). In the early part of 1916, the Laurentian, Big Master, and Jubilee were de-watered and sampled by the Dominion Reduction Company of Cobalt, but no further work was done by the Company. The *Glass Reef* (H.W. 391, H.W. 594) produced a little gold from a 10-stamp mill.

The Sakoose or *Golden Whale*[1] (H.W. 416, etc.) near Dyment station in the New Klondike region, mined and shipped ore to the Keewatin Reduction Works at Keewatin, Ontario, during 1899 to 1902. "The ore consists of a dark quartz containing variable quantities of zinc blende, chalcopyrite, pyrites and galena, lying in a fissure tight against the walls of brownish grey disturbed quartzose schist [felsite] . . A dike of quartz porphyry runs in and out through this broken up area of country rock and for long stretches lies against the quartz veins."[2]

Dryden

The geology of this area is included in Wm. McInnes'[3] Manitou Lake sheet. Further detailed work around Wabigoon lake was done by A. L. Parsons[4] and Ellis Thomson.[5] According to Mr. Thomson, the veins occur chiefly in the Keewatin, particularly near the Laurentian formation. The veins vary in width from a few inches to 20 feet or more, and consist chiefly of white quartz; ankerite, pyrite and black tourmaline are also quite plentiful, while chlorite, malachite, azurite, hematite, and native gold are rarer constituents. Only a small quantity of gold has been produced from three or four properties.

The Redeemer,—(S.W. ¼, S. ½, lot 7, con. 1, Van Horne), produced a small quantity of gold in 1905, from a 10-stamp mill. The deposit is apparently a lode of quartz and green schist with much pyrite, which has been worked to a depth of 235 feet with levels at 100 and 200 feet. The upper workings were de-watered in 1910, and later in 1919, by the *Contact Bay Mining Company*.. This company also operates the *Rognon*,[6] K. 635, (formerly the surveyed claim A.S. 14), where the vein "varies in width from two feet two inches, pinching and swelling alternately throughout the length. The vein material is reddish quartz highly impregnated with hematite and occasionally carrying a little pyrite"[7] and visible gold. The country rock is biotite schist. A shaft has been sunk 106 feet with 65 and 192 feet of drifting at the 50 and 100-foot levels respectively. A little gold has been recovered from a one-stamp testing mill[8]. At the

[1] Ont. Bur. Mines, Vol. X, 1901, pp. 89, 90, 101, 102,; Ibid, Vol. XI, 1902, pp. 11, 53, 57, 251, 255; Ibid, Vol. XII, 1903, p. 15.

[2] Ibid, Vol. X, 1901, p. 101, W. E. H. Carter

[3] Map No. 720, Manitou Lake Sheet, Rainy River District, Geol. Sur. Can. 1902.

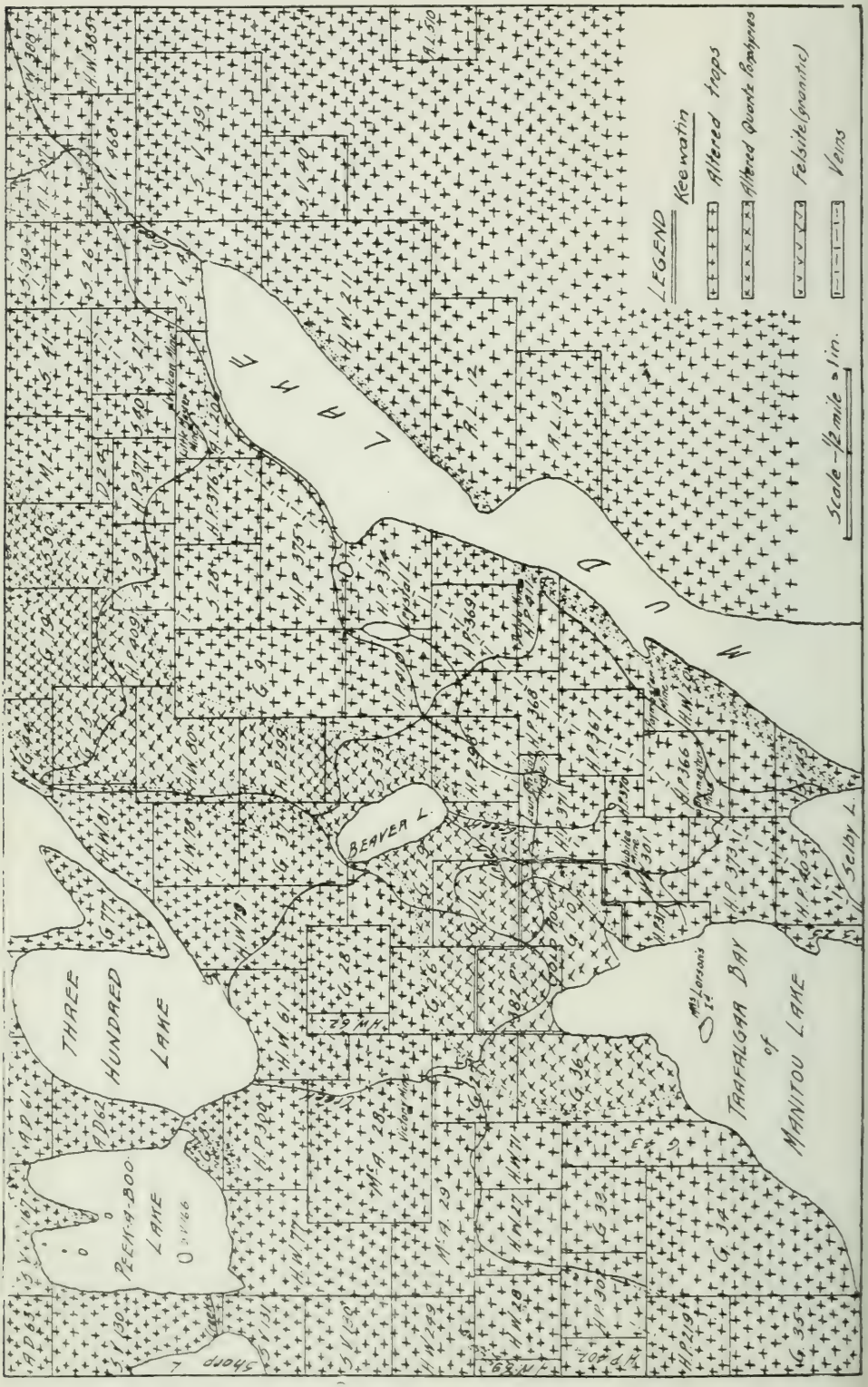
[4] Map on page 120. Ont Bur. Mines, Vol. XX, 1911, "Gold Fields of Lake of the Woods, Manitou and Dryden".

[5] Dryden Gold Area, by Ellis Thomson, accompanied by a geological coloured map, scale 8 miles to 1 in., Ont. Bur. Mines, Vol. XXVI, 1917, pp. 163-189.

[6] Can. Min. Jour., Dec. 10, 1915, by Jas. Bartlett.

[7] Ont. Bur. Mines, Vol. XXIV, 1917, p. 184, E. Thomson.

[8] Ibid, Vol. XXIX. 1920, p. 66.



Geological map of the Manitou area by A. L. Parsons. The altered traps include diabase, diorite and andesite. (Ont. Bur. Mines, Vol. XX, Pt. 1, p. 79).

Gold Moose (lot 8, con. 1, Van Horne), the shaft has been sunk to a depth of 114 feet. The vein, which is in trap, is 18 inches wide at the surface and 4 feet wide at the bottom. "In February of this year [1901] a mill test of 67 tons of ore made at the Keewatin Reduction works, is said by Hutchison Bros. to have given satisfactory returns."[1]

The League mine (N. ½, lots 5 and 6, con. 1, Van Horne) shows a vein consisting of quartz, ankerite, tourmaline, and pyrite with green mica and chalcopyrite. The country rock is dense felsite or quartz-porphyry. The shaft is 80 feet in depth. A one-stamp mill is on the property.[2] The *Cleveland* (lot 11, con. 1, Van Horne), has an 80-foot shaft on a small quartz vein in altered diabase.

Gold has also been found to the northeast of Dryden, on the Cross and other claims on *Minnitaki lake*.[3]

Eagle Lake

The geology has been worked out by Wm. McInnes in the Manitou Lake sheet of the Geological Survey of Canada, and is further discussed by W. G. Miller, W. E. H. Carter, E. T. Corkill, A. L. Parsons and others who also treat of the properties on which work has been done.[4] The important gold-bearing veins of the area are confined to the granite over a width of a mile or more from the contact with the green trap, which contact crosses Eagle lake with a tortuous but on the whole northeast-southwest strike.[5]

The *Grace* gold mine (M.H. 251), lies near the contact of Laurentian granite and altered quartz-porphyry of Keewatin age. Six veins have been located and a shaft sunk 135 feet on No. 1 vein where one level has been opened up. The vein consists principally of schist and bluish quartz. A tunnel has been driven into the hill 160 feet.[6] According to W. E. H. Carter, the veins are quite narrow, carrying galena, blende, pyrite and an unusual sprinkling of visible gold.[7] A 5-stamp mill was erected in 1907, and a little ore milled.[8] The *Golden Eagle* in 1903 had 29 tons of ore run through the Eldorado mill, producing $307.50 in gold.[9] The following four properties, some of which produced bullion in 1903, 1904, and 1905, have been worked by the *Northern Light Mining Company*. The *Baden-Powell* (S. W. end of South Twin island) has three quartz veins in granite, probably of Laurentian age. About 40 tons of ore were tested at the Eldorado mill.[10] Later, a 5-stamp mill was erected and a shaft put down 135 feet.[11] The *Eldorado* (M.H. 257), has a 31-foot shaft on a vein in Laurentian granite. A 2-stamp mill was erected. Considerable exploratory mining was also done on the *Buffalo* (M.H. 246), and on *Pioneer Island* (McA. 245). On the latter an 80-foot shaft has been sunk on a vein of pyrite and quartz on a contact of granite and trap.[12]

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[1] Ont. Bur. Mines, Vol. XI, 1902, p. 244, W. E. H. Carter.
[2] Ibid, Vol. XXVI, 1917, p. 181, Ellis Thomson.
[3] Ibid, Vol. VIII, 1898, pp. 69-72; Vol. IX, 1899, p. 64.
[4] Ibid, Vols. XII, 1903, to XVII, 1908, inclusive and Vol. XX, 1911.
[5] Ibid, Vol. XX, 1911, p. 196, A. L. Parsons.
[6] Ibid, Vol. XIII, 1904, p. 64, W. E. H. Carter.
[7] Ibid, Vol. XIII, 1904, p. 64, W. E. H. Carter.
[8] Ibid, Vol. XVII, 1908, p. 64, E. T. Corkill.
[9] Ibid, Vol. XIII, 1904, p. 64, W. E. H. Carter.
[10] Ibid, Vol. XII, 1903, p. 93, W. G. Miller.
[11] Ibid, Vol. XX, 1911, p. 197, A. L. Parsons.
[12] Ibid, Vol. XIV, 1905, p. 49, W. E. H. Carter.

Lake of the Woods and West Shoal Lake

The geology of Lake of the Woods has been worked out in detail by A. C. Lawson[1] and minor changes and additions have been made by A. P. Coleman, and A. L. Parsons. Prof. Coleman[2] wrote three detailed reports on the "Western Ontario Gold Regions," in 1894, 1895, and 1896. Later, in 1910, 1911, and 1912 Mr. Parsons[3] did detailed mapping in the vicinity of some of the mines and reported on the accessible properties. These have been described from year to year by the Mining Inspectors of Ontario, and a brief account is given in the International Geological Guide Book No. 8 published by the Geological Survey of Canada, in 1913.

Gold mining began around Lake of the Woods about 1883, the greatest activity being in the year 1897. The principal producers were: the *Sultana* which yielded between $700,000 and $1,000,000 the *Mikado*, and the *Regina* or *Black Eagle*; the production of the latter two was approximately $500,000 each. Small quantities of bullion have come from Ophir, Olympia, Golden Horn, Cornucopia, Cameron Island, Winnipeg Consolidated, Pine Portage, and the Keewatin Contact. The production from a number of the smaller properties was obtained from mill tests only. Mining has been carried on intermittently at most of the properties; none of the mines were in operation during 1920.

The rocks are of pre-Cambrian age, consisting of Keewatin horneblende, chlorite, sericite schist, etc., Laurentian granite and gneiss, a series of granites, porphyries and felsites younger than the Laurentian (probably Algoman), and a few Keweenawan diabase dikes. The Keewatin hornblende schists, altered traps, are the most important rocks, since the main ore deposits are located in them, as at the Sultana, Regina, and Mikado; the ore in the latter two mines also extends into the adjoining granite, which may be responsible for the gold.

The veins are chiefly of the fissure type, with quartz and some ferro-dolomite. They frequently cut across the contact between granite and Keewatin altered volcanics.

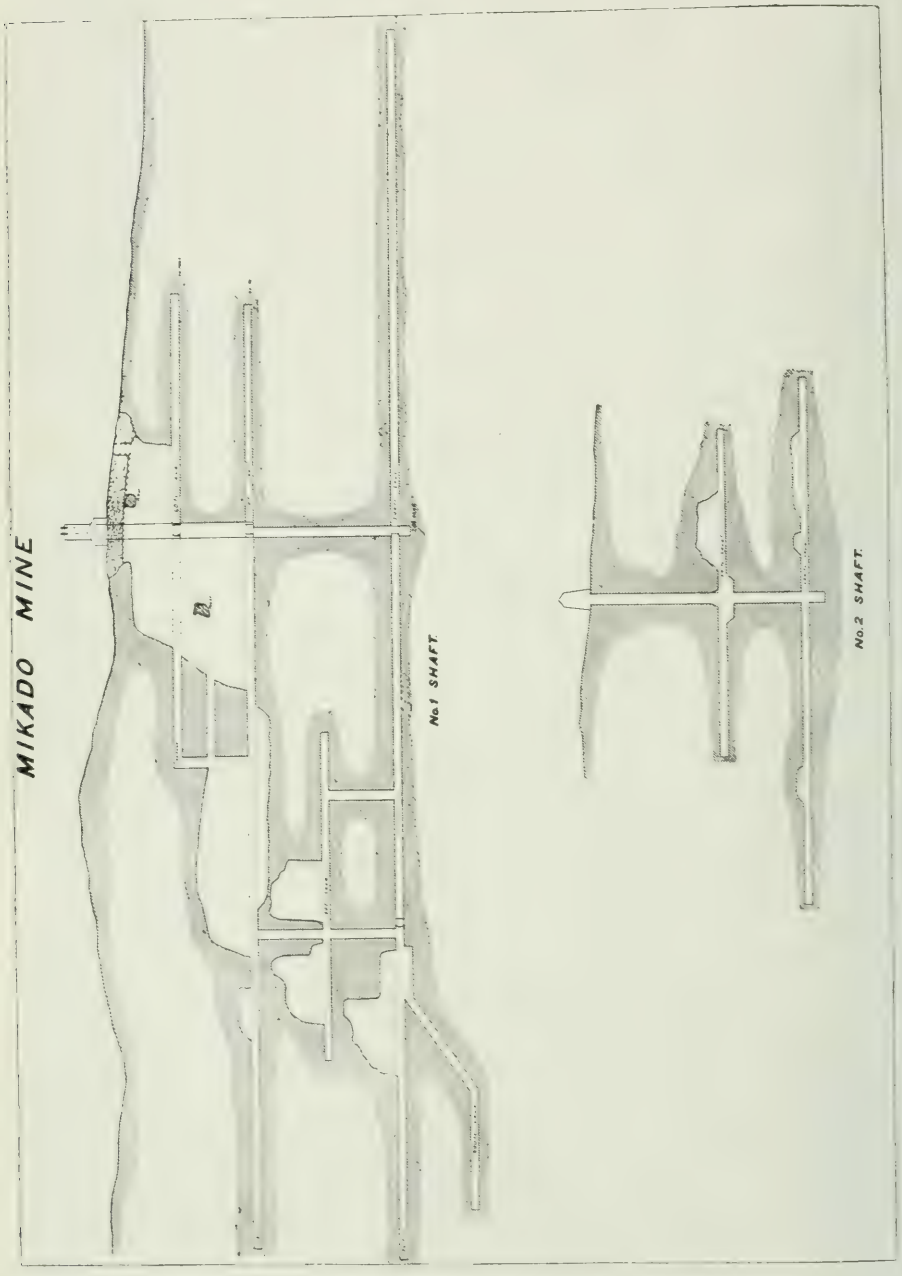
The *Mikado* (D. 148) was discovered in 1893, operated up to 1903, and again in 1910 and 1911. The mine produced approximately $500,000 in gold, the ore running $8 and up per ton. According to A. L. Parsons, the rocks are Keewatin traps, basalts altered to hornblende and chlorite schists and andesite and quartz porphyry, which have been intruded by felsite dikes and sills, and granite. The main vein is of the fissure type and consists of blue and white quartz averaging from 4 to 5 feet in width and carrying pyrite, chalcopyrite, bismuthinite, molybendite, malachite, native gold, chlorite, and tetradymite. An inclined shaft has been sunk to a depth of 540 feet, 1,300 feet on the incline, and nine levels have been opened up. The stoping has been done principally in the felsite and for a short distance in the adjoining traps. A less important

[1] Report on the Geology of Lake of the Woods Region, Ont., Geol. Sur. Can. Annual Rep., 1885, Pt. CC; See also reprint of Prof. Lawson's map in Ont. Bur. Mines, Vol. VI.

[2] Ont. Bur. Mines, Vols. IV, 1894, V, 1895, and VI, 1896.

[3] Ibid, Vols. XX, 1911, XXI, 1912, and XXII, 1913.

Geological map, scale 4 miles to the inch, of northern part of Lake of the Woods, by A. L. Parsons.



Vertical section of underground workings, Mikado mine, Lake of the Woods area, scale, 1 inch=160 feet. (Ont. Bur. Mines, Vol. IX, p. 53).

vein occurs in the adjoining granite[1]. The best values are always found where one or both walls are composed of granite[2]. The mine may be re-opened during 1922.

The *Cornucopia* (Cedar Island No. D. 212). The shaft was sunk on a vein carrying much pyrrhotite. The gold recovered was valued at $1,560.

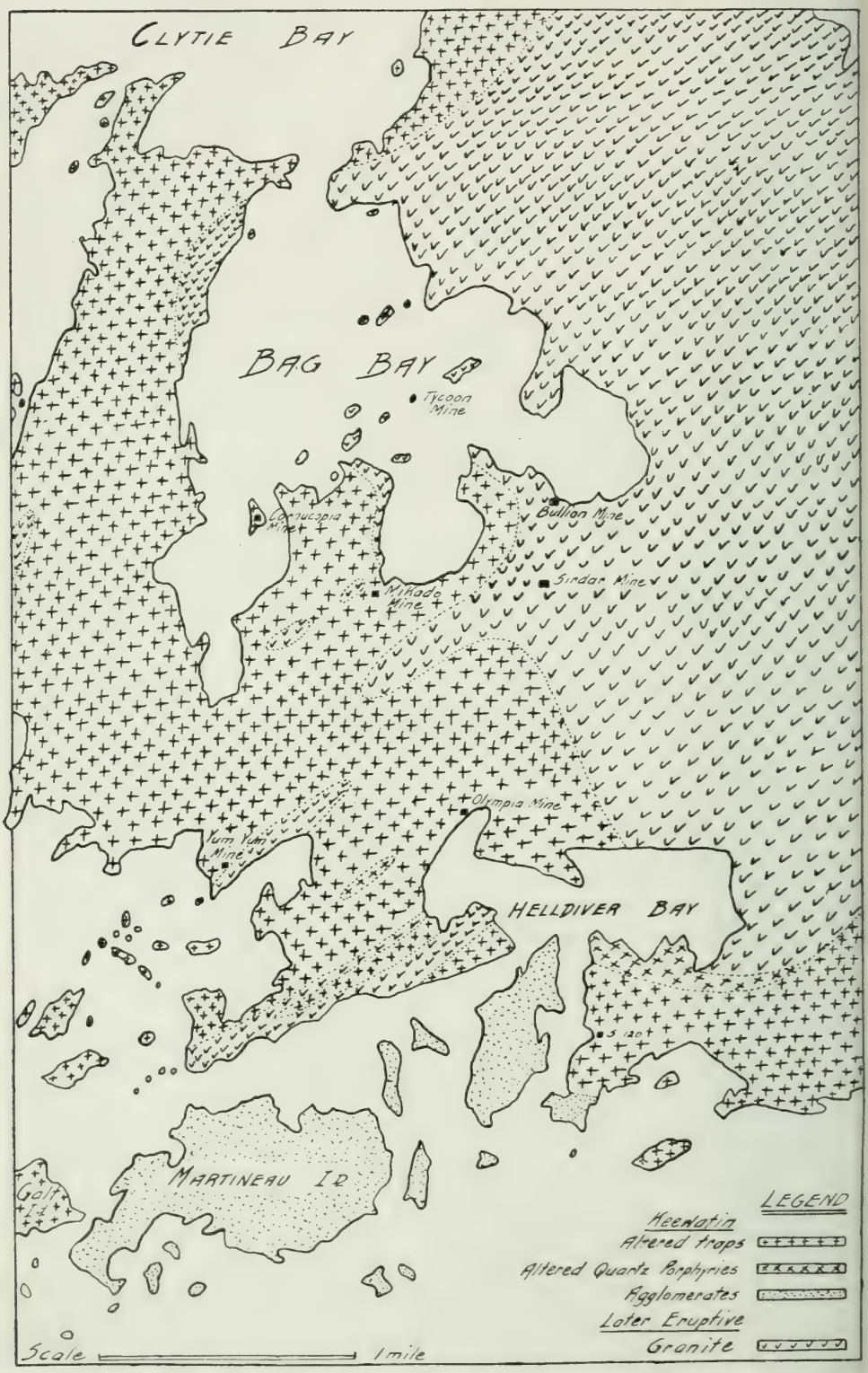
The *Olympia* (M. 11) has a quartz-calcite vein from 3½ to 6 feet in width in Keewatin diabase. Gold valued at $2,101, was produced in 1912 from a 10-stamp mill. Some ore was also milled in the summer of 1915. There are five shafts and three tunnels on the property[3].

Cameron Island.—(S. 170). The rocks are amphibolite, altered trap, intruded by felsite. The main quartz vein is four feet wide carrying much pyrrhotite, pyrite and chalcopyrite[4]. A mill run in a 5-stamp mill yielded $200 in gold the ore averaging about $10 per ton. According to T. F. Sutherland,[5] the shaft has been sunk 132 feet with 500 feet of lateral work on the 63 and 127-foot levels. The mill has been replaced by two Forsythe pulverizers, a rotary roasting kiln and two amalgamation plates.

Golden Horn or *Rush Bay* (D. 288) produced some gold in 1905 from a 2-stamp mill. According to W. E. H. Carter, "the vein is very irregular in width, waving in and out from a mere stringer to a solid quartz body 3½ feet wide. The one solid band occasionally breaks up into several, which then interband with the chloritic schist forming a well-defined deposit several feet wide."[6] The quartz varies from a white variety with a little iron pyrites to a smoky quartz carrying galena, blende, chalcopyrite and pyrite.[7] "No. 1 shaft has been sunk, to a depth of 225 feet, and 175 feet of drifting has been done in both directions on the vein on the first level. On the third level a cross-cut has been driven south 285 feet. No. 2, shaft is 113 feet deep on a vein 84 feet south of No. 1, vein."[8]

The *Regina* mine (556 P. 557 P.), later known as the *Black Eagle*, began mining and milling in 1895 and worked continuously until October, 1899. The property was in operation for a short time during 1902 and also in 1905, the total production being approximately $500,000. The ore occurs as a nearly vertical chimney or ore shoot in a "true fissure" vein. According to A. L. Parsons[9] "The vein upon which the shaft is sunk varies in width from about 2 feet to 6 feet with a general average [in the four upper levels] of about 4 feet, and at only one place was a width of less than two feet noted. The vein cuts the contact of granite and a more or less altered trap [the ore occurring in both formations] . . The shaft has been sunk to a depth of 545 feet and nine levels have been opened up at intervals of 60 feet . . .The vein is principally quartz, though in places a fair

[1] Ont. Bur. Mines, Vol. XX, 1911, pp. 164-5; Vol. XXI, 1912, pp. 192-3.
[2] Ibid, Vol. XII, 1903, p. 95, W. G. Miller.
[3] Ibid, Vol. XX, 1911, p. 162; Vol. XXV, 1916, Pt. 1, p. 68.
[4] Ibid, Vol. XX, 1911, p. 166, A. L. Parsons.
[5] Ibid, Vol. XXV, 1916, p. 66.
[6] Ibid, Vol. XIII, 1904, Pt. 1, p. 61.
[7] Ibid, Vol. XI, 1902, p. 252.
[8] Ibid, Vol. XV, 1906, p. 59, E. T .Corkill.
[9] Ibid, Vol. XX, Pt. 1, p. 173.



Map of West Shoal lake, Lake of the Woods area, by A. L. Parsons. (Ont. Bur. Mines, Vol. XX, Pt. 1, p. 79).

ercentage of a rusty carbonate is found intermingled with the quartz." Ac-ording to James A. Bow,[1] the stope, which has been carried through from he sixth level to the surface, averages about 6 feet in width and is approximately 0 feet in length on the levels; the vein in the lower workings is 7 to 12 feet

Vertical section of underground workings, Regina Mine, Lake of the Woods area, scale—160 ft.=1 inch. (Ont. Bur. Mines Rep., Vol. IX, p. 451).

n width, possesses good walls and averages about $7 per ton. Gold has also been ound on the property in quartz veins in granite, and in quartz stringers cutting usty carbonate. There is a 40-stamp mill and other buildings and equipment. Cyanide was used in recovering the gold.

[1] Ont. Bur. Mines, Vol. VIII, 1899, p. 57; Vol. IX, 1900, p. 46.

The *Canadian Homestake,* formerly known as the *Scramble* (lots 13, and 14, concession VI, Jaffray township), was located in 1894, and was partially explored. After lying idle for thirteen years the property was re-opened in 1911, and operated by electric power from Kenora. According to A. L. Parsons, the ore body is a fahlband about 30 feet wide, containing veins and stringers of quartz and ankerite and considerable pyrite, and resembles iron formation occurring in altered diabase which in places exhibits a pillow structure.[1] "The company continued development work until September 15th, 1914, when all work was stopped. At that date the underground development stood as follows:— The shaft was 225 feet deep and timbered to 200 feet. On the 55-foot level a cross-cut was driven a distance of 60 feet. On the 75-foot level a cross-cut was driven 27 feet and a sump cut. On the 200-foot level a drift was driven 100 feet and a sump cut."[2]

The *Sultana mine* (42X) began operation in 1891 and worked almost continously until it closed in 1906, the production during that time being between $700,000 and $1,000,000,which is the largest yield from any gold mine in northwestern Ontario. The ore averaged about $8.00 per ton and had a fineness of about 840. The workings are about 600 feet deep, which is the greatest depth reached in any gold mine in this area. According to A. P. Coleman[3] the deposits are bedded veins [lodes?] in Keewatin hornblende and chlorite schist [altered trap] near granite and granite-porphyry which may be of Laurentian or later age. Some veins are also in the granite. "In addition to native gold it is reported that considerable molybdenite was found in this mine, and the tailings along the shore show that there was a large quantity of pyrite and other sulphides in the vein".[4] "The latest developments appear to show that the ore body is a large irregular chimney extending through all the levels from the second down."[5] The main stope has a minimum cross-section of about 25 feet by 25 feet and a maximum of about 60 by 120 feet. The ore shoot was cut off by a fault on the seventh level.[6] There is a 30-stamp mill and other surface equipment.[7]

The *Ophir* (A. 20) vein is entirely in unaltered granite porphyry (Laurentian?) near Keewatin altered trap. A little gold was obtained in 1911. According to A. L. Parsons,[8] a shaft has been sunk 160 feet deep with levels at depths of 40 and 100 feet. The vein is apparently a lode consisting of a few lenses and bands of quartz separated by micaceous and chloritic material and granite-porphyry.

Winnipeg-Consolidated (F 22, and X 85).—A. L. Parsons says, "The vein of the Winnipeg Consolidated mine was seen in the shaft, and at a depth of 6 feet it has a thickness of about three feet and is between walls of altered diabase."[9] Ore was mined and milled in 1883. According to E. Coste, "the true vein of massive quartz . . .. was found to be narrow (6 inches to 2 feet); it is certainly

[1] Ont. Bur. Mines, Vol. XX, 1911, p. 175; Vol. XXII, 1913, p. 227.

[2] Ibid, Vol. XXIV, 1915, p. 96.

[3] Ibid, Vol. IV, 1894, p. 68.

[4] Ibid, Vol. XX, 1911. p. 169, A. L. Parsons.

[5] Ibid, Vol. VIII, 1899, p. 50, James A. Bow.

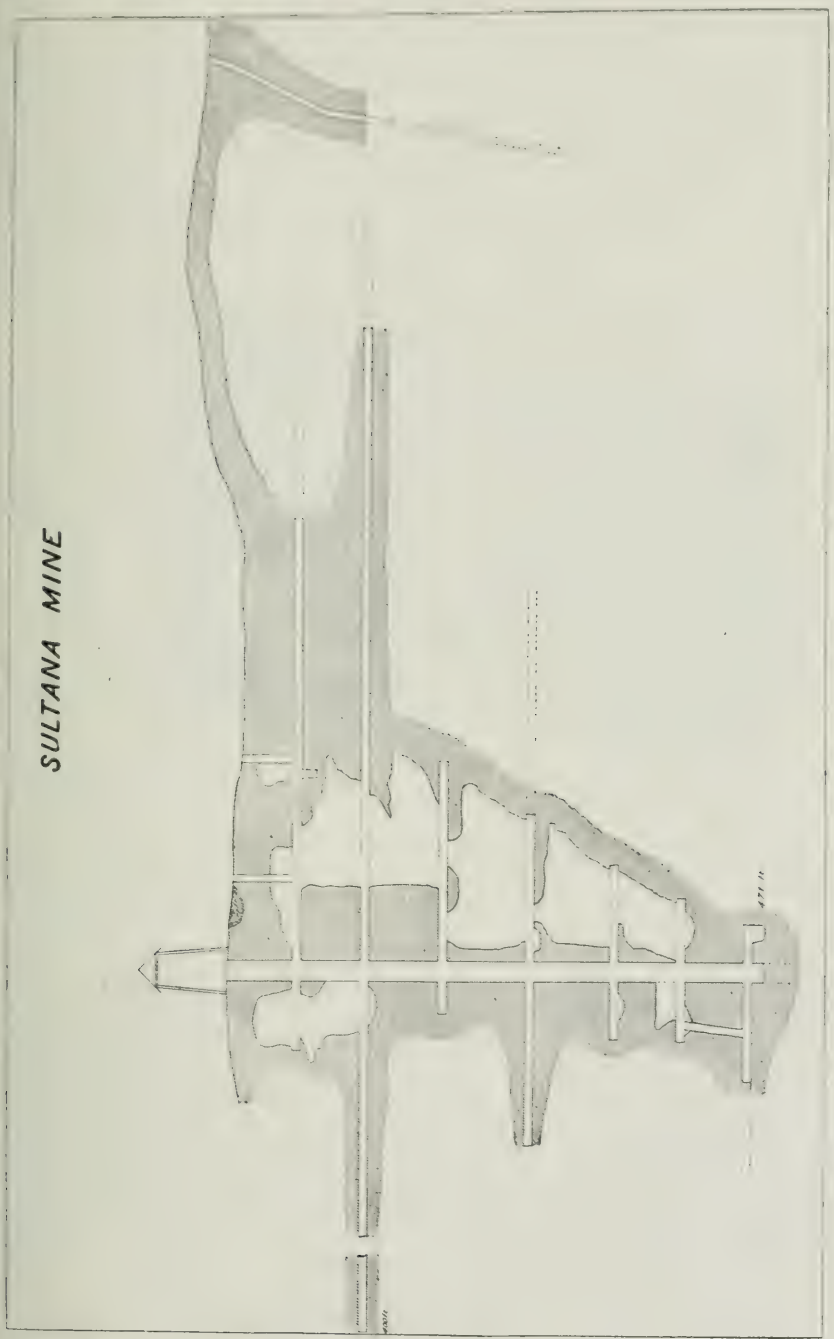
[6] Jour. Can. Min. Instit., Vol. VII, 1897, p. 132, W. E. H. Carter.

[7] Ont. Bur. Mines, Vol. XX, 1911, Pt. 1, p. 170.

[8] Ibid, Vol. XXII, 1913, Pt. 1, pp. 226-7.

[9] Ibid, Vol. XX, 1911, p. 172.

auriferous . . ., it contains besides iron and copper pyrites, mispickel, a little calcite and a very little galena and blende.[1]"



Underground workings of the Sultana, Lake of the Woods area, scale: 170 ft.=1 inch
The shaft is now 600 feet deep and a drift on the third level has reached the Crown Reef vein, 750 feet from the main shaft, where some ore was stoped
(Ont. Bur. Mines, Vol. IX, p. 39).

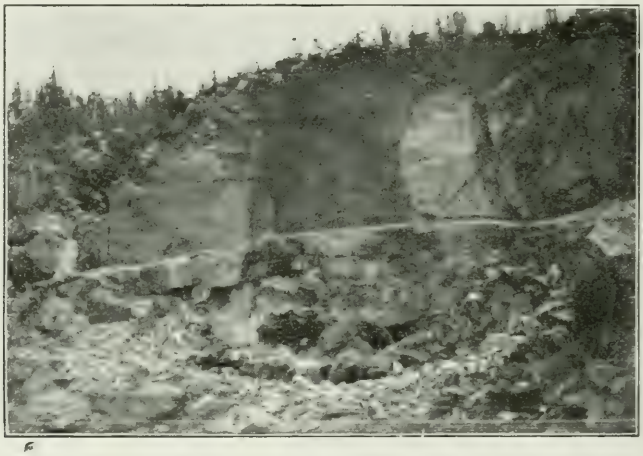
Pine Portage.—"Ore was milled as it was taken from a 100-foot shaft in 1884. The vein is a quartz fissure over 7 feet in width; it is certainly very auriferous and is impregnated with iron and copper pyrites, blende, galena, mispickel

[1] Geol. Sur. Can., 1882-4, p. 11k, 12k.

and a little covellite."[1] The lead is a fissure cutting a hard massive schistose hornblende rock at a distance of only 150 feet from a granite mass towards which it dips."[2].

Keewatin.—"In 1884, ore was shipped in barges to the stamp mill of the Argyle mine. The quartz, which is rich in iron and copper pyrites and in mispickel, runs in small veins between the laminæ of the schist, forming a total width of about six feet of impregnated matter."[3].

The Combined mine lies two miles east of the south end of Camp bay—"37 tons of ore were milled in July, [1903], producing gold, according to the superintendent, to the amount of $10.50 per ton."[4] "The vein is nearly horizontal . . . lies between overlying trap, exhibiting a pillow structure, and a dark underlying



Flat quartz vein overlain by trap, Combined gold mine, Lake of the Woods area. (Ont. Bur. Mines, Vol. XIII, Pt. 1, p. 48).

felsite or fine-grained quartz (?) porphyry. With the quartz, which in the principal vein varies from two to four feet in thickness, is a large body of rusty carbonate rock which seems to be derived from the alteration of quartz (?) porphyry or felsite and shows considerable sericite.[5].

Numerous other prospects in the area have made mill tests or shipped ore to the smelters, from which a few hundred dollars were recovered. A number of the following come under this class: *North Crown* (formerly called *Gold Hill*, 70 K); *Homestake*, P. 64; *Champion* or *Good*, P. 349; *Gold Creek*, P. 347; *Eldiver*, P. 351; *Treasure*, P. 400; P. 409; *Caribou*, P. 288; *Bulldog or Black Jack*, X. 90; *Rajah*, P. 317; *Standard*, McA. 251; *Bully Boy*, S. 79; *Triggs*, McA. 56; *Flint Lake*, McA. 285, 286; *Crown Point; Bullion; Triumph; Nonesuch; Boulder Island; Golden Gate; Master Jack; Dead Broke* or *Climax; Princess; Black Sturgeon; Sirdar; Tycoon; Yum-Yum; Nino;* J.E.S. 93; *Violet*, (produced gold in 1907.

[1] Geol. Sur. Can. 1882-1884, p. 15k, E. Coste.
[2] Ibid 1885, pp. 141, 142, CC., A. C. Lawson.
[3] Ibid, 1882,-1884, p. 10K.
[4] Ont. Bur. Mines, Vol. XIV, 1905, p. 48.
[5] Ibid, Vol. XXI, 1912, p. 190, A. L. Parsons.

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THIRTIETH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

VOL. XXX, PART III, 1921

Gowganda and Other Silver Areas

By A. G. Burrows

I. GOWGANDA SILVER AREA (Fourth Report)

II. AULD AND CANE TOWNSHIPS

PRINTED BY ORDER OF
THE LEGISLATIVE ASSEMBLY OF ONTARIO

TORONTO:
Printed and Published by CLARKSON W. JAMES, Printer to the King's Most Excellent Majesty
1922

Printed by
THE RYERSON PRESS.

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No. 30b.—Part of the Gowganda Silver Area (Second Edition, 1921.)

(In pocket on inside of back cover.)

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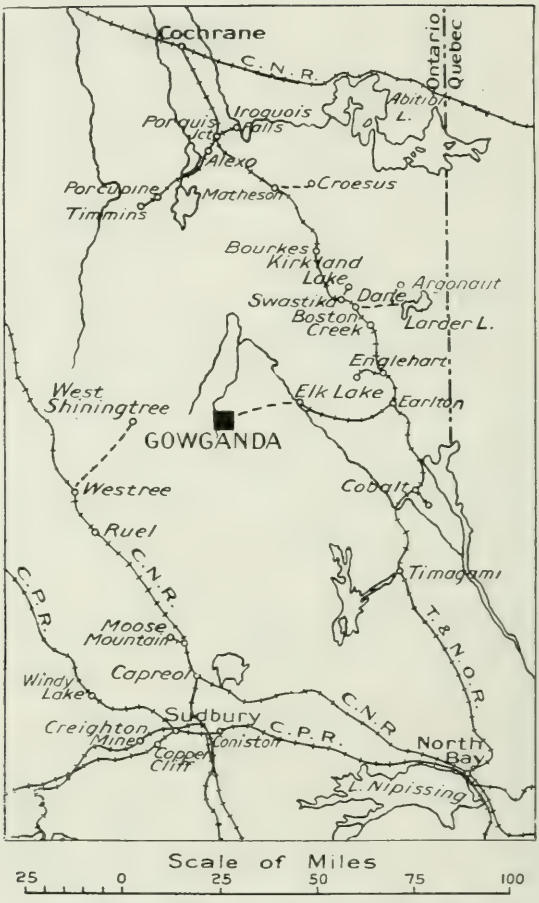

Sketch Map showing location of Gowganda.

I.—GOWGANDA SILVER AREA

(Fourth Report)

By A. G. Burrows

Introduction

The greater part of the field season of 1920 was spent by the writer in revising the geology of the Gowganda Silver area, special attention being given to the occurrence and structure of the Nipissing diabase sill with which the silver deposits are associated.

H. T. Leslie and H. C. Rickaby of Toronto acted as assistants and performed their work well. A number of cross-sections illustrating the position of the diabase sill in its relation to the other formations were prepared from their field work.

The map accompanying the report is a revision of that published in 1910 to accompany the Second Report on the Gowganda Silver Area. It has been enlarged to include portions of the townships of Donovan and Corkill, where discoveries of silver have been made in recent years. Part of the geology in Shillington, Chown, Lawson and Corkill townships has been taken from W. H. Collins' map (1) of the Gowganda area.

Gowganda Lake looking south-west from "Tower" hill.

Location

The Gowganda Silver Area is situated in the south-west part of the District of Timiskaming and forms part of the Timagami Forest Reserve. Gowganda (2) lake, from which the area derives its name, lies about 56 miles north-westerly from Cobalt. The nearest railway station is Elk Lake, the terminus of a branch line running westerly from Earlton, which

(1) Geol. Survey of Canada, issued in 1913.

(2) Gowganda is an Indian name, meaning "porcupine's home."

is on the main line of the Temiskaming and Northern Ontario Railway. From Elk Lake there is a motor road, 27 miles in length, to the village of Gowganda. The easterly part of the road from Wigwam to Elk Lake is in good condition for motor traffic, and it is planned to improve the westerly portion in 1922. A stage operates daily, except Sunday, between Elk Lake and Gowganda.

Topography

The general character of the surface of the country is quite similar to that of other parts of the pre-Cambrian of Northern Ontario. Viewed from hilltops, the surrounding horizon presents a series of gentle undulations with here and there a break, caused by a prominent hill or ridge. In detail, however, the surface is very rough and broken, and different geological formations present differences in surface contour. Rocky ridges alternate with swampy depressions abounding in small lakes over much of the area. The large lakes usually have considerable rocky shore-line, and the water in them is clear. Generally, the longer axes of the lakes are north and south, this being the prevailing direction of the ridges.

The area is situated near the head-waters of the Montreal river, and most of it is drained by the waters of the East Branch of that river, which, together with other streams, flow northward. There is a marked parallelism in the large lakes, which are quite numerous: Spawning, Elkhorn, Gowganda, Obushkong, Bloom, Wigwam, Lost and Calcite lakes. The depressed valleys in which these lakes are found probably originated in extensive north-south fault movements.

The most prominent features are the diabase, conglomerate and greywacké ridges; whereas the granite and syenite of the Laurentian, and the schists of the Keewatin generaliy occur in low rounded ridges and depressed parts of the area. The highest elevation is attained southwest of Spawning lake, in a greywacké ridge, which is 400 feet above the surrounding level, or about 1,550 feet above the sea. The conglomerate hill to the north east of Obushkong lake is 200 feet above the lake. The diabase ridge at the Gamey-Thompson property in the west part of Van Hise is 200 feet above the plain. Usually the ridges vary from 50 to 150 feet in elevation.

Superficial Deposits

The superficial or unconsolidated material is chiefly sand and gravel and sandy and gravelly loam of glacial origin. The area lies some miles south of the southerly limit of the great clay belt of Northern Ontario. There is no large tract of agricultural land, although in small patches near Gowganda village and at some of the mines fine vegetables are grown.

Jack pine plains and rolling sand ridges are characteristic of most of the south and east parts of the area.

Large parts of Charters, Lawson and Corkill townships are covered with sand deposits which conceal most of the rocks. Some of the low, swampy areas are extensive, as in the northeast part of Leith township.

The timber is chiefly white and black spruce, birch, balsam, jack pine and poplar. Red and white pine are found in small groves in isolated parts. Around Gowganda lake the timber is mostly small, but to the south, in Leith and Charters townships, it is of good commercial size.

Forest fires have destroyed large tracts of timber, particularly in the townships of Haultain, Nicol and Van Hise.

Glaciation

The marks of glaciation, varying from fine striæ to broad grooves or rounded hummocks, are evident at many points. The ice mass moved about due south in this area. Immediately west of Myrtle lake the glacial striæ are S. 10 deg. E. mag., and about 3 miles south on the Crawford claim, H. S. 359, they are S. 20 deg. W. magnetic.

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1920.—A. G. Burrows, Gowganda Silver Area, Ont. Dept. of Mines, Vol. XXIX, Part III., 1920.

Production

Shipments have been made from the Gowganda area from the year 1910 up to the present. These have been derived from properties in the vicinity of Miller lake and west of Gowganda lake, together with a few isolated shipments from outlying townships. The great preponderance of ore shipped has come from northwest of Miller lake. Several shipments of high-grade ore have been made from the Mann ridge west of Gowganda lake. From 1910 to 1912 the Millerett mine was the chief producer, the ore coming chiefly from a shoot in the conglomerate which produced 500,000 fine ounces. The Miller Lake O'Brien, which has supplied most of the silver ore yet shipped from Gowganda, has been producing continuously since 1909. The latest property to make shipments is the Castle, ore being obtained not only from the diabase sill but from the Keewatin.

A table is appended giving the production of the mines of Gowganda from the beginning until the end of 1920, the total number of fine ounces of silver being 5,877,592, and of pounds of cobalt "paid for" 134,950.

PRODUCTION FROM GOWGANDA MINES, 1910-1920

Mine	Ore and Concentrates, Tonnage Shipped												Silver,	Cobalt,
	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	Total Tons	ounces	lbs.
Bartlett	*													
Crews-McFarlan									30.20	42.00		72.20	20219	
Bonsall	3.79										13.059	16.849	10046	101
Boyd Gordon	27.00											27.00	4678	
Burk-Remey	1.8											1.8		
Calcite Lake		*												
Canadian Gowganda		*												
Castle (Trethewey)											45.31	45.31	48373	
Miller Lake and Everett		*												
Kell											.792	.792	1621	254
Mann			13.74	15.87	18.00							47.61	97792	
Millerett	347.0	128.0	192.00									667.00	611822	5000
Miller-Lake O'Brien	31.0	141.5	112.60	166.90	113.90	109.66	170.57	350.00	160.40	189.79	115.087	1661.407	4993457	129595
Powerful	*													
Reeve-Dobie	54.0						11.00	5.75		1.94	10.44	83.13	88584	
Welch	1.0											1.00	1000	
Total Ore & Concentrates, tons	465.59	269.5	318.34	182.79	131.90	109.66	181.57	355.75	190.60	233.73	184.688	2624.118	5877592	134950
" Silver ounces	471688	468687	549976	502370	399300	242229	383393	1064635	638198	723764	433352	5877592		
" Cobalt (paid for) lbs	8432							56884	26994	27404	15236	134950		

* In addition to the shipments reported to the Department of Mines and shown in the table of production, A. A. Cole's reports for the Temiskaming and Northern Ontario Railway Commission show the following additional shipments:

1909—Bartlett, 2 tons
1910—Everett, 8.35 tons; Powerful, 1 ton:
1911—Calcite Lake, 8.5 tons; Canadian Gowganda, 8 tons

Note.—Shipments of about 6½ tons have been reported in addition from the Hudson Bay properties in Leith township. The silver contents of the Burk-Remey shipment were never reported to the Department.

Table of Formations

The compact rocks of the area are of pre-Cambrian age. The chief geological subdivisions are as follows:

POST-KEWEENAWAN—	Olivine-diabase, quartz-diabase, aplite.
KEWEENAWAN—	Quartz-diabase (sill)
	Intrusive Contact
ANIMIKEAN— (Cobalt Series)	Upper: Conglomerate, quartzite, arkose. Lower: Conglomerate, greywacké, quartzite.
	Unconformity
LAURENTIAN (?)—	Granite, syenite, gneiss.
	Intrusive Contact
KEEWATIN—	Basic and acidic volcanic and intrusive rocks, iron formation, chlorite and hornblende schist, &c.

Note: A number of diabase dikes are older than the Cobalt series and are probably later than the Algoman. They intrude the Laurentian and Keewatin.

Dikes of lamprophyre and dikes and masses of serpentine intrude the Keewatin. They may be of the same age as similar rocks at Cobalt to which W. G. Miller and C. W. Knight have given the name Haileyburian.

General Geology

The rocks at Gowganda are in general similar to those at Cobalt and other parts of Northern Ontario where the pre-Cambrian predominates. The oldest are of Keewatin age, consisting of altered volcanic rocks; greenstones, volcanic fragmental, &c., also iron formation, and with dikes of light-coloured porphyritic rocks. The whole series has been greatly altered to schist, of which hornblende and chlorite schist form a large part. They are in marked contrast, from their ancient metamorphosed appearance and frequent vertical attitude where banded, to the later rocks.

The Keewatin was intruded by batholiths and smaller masses of granite and syenite, that are probably of Laurentian age. Some small masses of serpentine occur in the Keewatin, and numbers of basic dikes older than the Cobalt series intrude the Keewatin and Laurentian. These dikes were intruded long after the granite and syenite and are little disturbed.

This complex of older rocks was subjected to erosion, and on the irregular weathered surface the sediments of the Cobalt series were deposited. This series lies in gentle folds, with average dip of 10 deg. to 15 deg., and has been little disturbed except by the sill-diabase intrusion, when the dip is often higher on the hanging-wall side.

Later than all these rocks is a diabase sill or possibly sills, which occur for the greater part in the sedimentary rocks. Occasionally the diabase has been intruded below the contact of the Cobalt series with the Keewatin, since areas of the oldest rocks lie on the sill in the vicinity of Miller lake. A few basic dikes of olivine diabase and quartz diabase have intruded not only the older rocks but also the diabase sill. These are the youngest recognized rocks in the area.

Quartz-diabase dikes are found in part of the area intruding the Cobalt series, being more common in Leith township than elsewhere. They may also be younger than the sill diabase, but, not being found in contact with the sill, their age cannot be definitely determined other that they are later than the Cobalt series.

Keewatin

The rocks of Keewatin age occur in less volume than the Laurentian, Animikean and Nipissing diabase. They are distributed in isolated areas in several townships, the largest volume of these ancient rocks being in Van Hise, Haultain and Nicol.

The rocks are essentially of volcanic origin, and vesicular and ellipsoidal structures are occasionally seen. They are dominantly of basic composition, and are much altered to hornblendic and chloritic schists. Some of the rocks are massive, but most of them are altered to schist. Intermingled with the basic lavas are some fragmental rocks that resemble old conglomerate, together with some tufaceous or volcanic fragmental material. There are a few belts of banded iron formation, or jaspilyte, now much crumpled. There are also numerous narrow bands of light-coloured rock, like old felsitic or porphyritic dikes, that are folded with the darker volcanic rocks, and which appear to have been intruded at an early time into the volcanic flows. When banded, the Keewatin rocks are in nearly vertical attitude, with a general strike about east and west. Very fissile rocks are common, and also schists that break into flat plate-like structures an inch or more in thickness.

Small masses of serpentine, together with narrow dikes of felsite, porphyry, lamprophyre and diabase, occur frequently in the Keewatin areas.

Types of Keewatin

Hornblende schist and amphibolite occur south of the southwest end of Everett lake. Part of the rock is banded, breaking into plates. A microscopic section shows green fibrous hornblende, the predominating mineral, with grains of zoisite, epidote, secondary feldspar and chlorite.

A greenish weathering massive rock occurs north of Miller lake. A specimen from the south line of claim R.S.C. 87 is scaly fibrous green hornblende, and may be called amphibolite. To the east of Miller lake the rock is more schistose, and is largely hornblende and chlorite schist.

West of Leroy lake the greenstone is much altered, and has a dull green mottled appearance. The rock is rather massive, but passes westward into schist, striking N. 65 deg. E. and dipping 70 deg. N.

To the west of Obushkong lake there is considerable hornblende schist and associated serpentine which is much weathered to a rusty brown color. The serpentine rock also contains some fibrous hornblende and magnetite.

A light-coloured rock is interbanded with greenstone to the west of Obushkong lake. It is fine-grained, consisting of crushed quartz and feldspar with glistening scales of white mica. A dark mineral in thin scales is chlorite, giving the rock a gneissic texture.

Pillow lava occurs half a mile north of Serpentine lake. It is interbanded with a dark-coloured volcanic fragmental rock, one-half mile northeast of Leroy lake. It occurs again on claim W. J. 7, southwest of this lake.

Amygdaloidal lava is associated with iron formation west of Elkhorn lake along the boundary line of Milner and Leith townships. The vesicles of the old lava are filled with quartz, calcite and epidote. Under the microscope the flow structure of the rock is beautifully shown in the parallel arrangement of the minute rods of plagioclase feldspar.

Iron Formation

Banded iron formation occurs in a small area of Keewatin southwest of Elkhorn lake and also one-half mile northeast of Gowganda lake. The formation is quite limited, consisting of interbanded silica and magnetite in thin layers less than 30 feet in width. No iron ore of importance occurs in these localities. The formation is quite crumpled in several separated small bands on claims W. D. 961-964. One silicious band on claim W. D. 963 contains a small deposit of massive iron pyrites.

Dikes in Keewatin

North of Brett lake are several narrow dikes of a reddish brown lamprophyre. The phenocrysts are augite set in a groundmass of feldspar and scales of fibrus hornblende. Calcite in grains and veinlets is also seen.

In the same area there are several dikes of rather fresh-looking diabase. A microscopic examination of one proves it to be a hornblende diabase. The age of many of the diabase dikes cannot be stated definitely, since several that are fresh-looking have proven to be of vastly different age in other parts of the area.

Quartz-Porphyry

There is a large mass of greenish-grey quartz-porphyry directly northeast of Gowganda lake. It forms the main rock of a number of mining claims, many of which show simply the porphyry and narrow north-south dikes of diabase. The porphyry intrudes green schist and iron formation on claims W. D. 961 and is therefore younger than certain of the Keewatin rocks. On the previous geological map of Gowganda it was classed with the Keewatin. It occurs rather as a stock than a dike since its outcrop is nearly round in shape.

No gold has been found in this rock, as in certain quartz-porphyries in some parts of northern Ontario. The formation may possibly be of Laurentian age.

Phenocrysts of quartz are frequently recognized in the porphyry, although there are portions of the mass that are simply a light greenish-grey felsite.

A section of a sample from the south line of claim R. S. C. 123 shows abundant quartz phenocrysts and a few ragged outlines of feldspar. The groundmass is granular quartz and feldspar with a little chlorite.

Laurentian

The rocks at Gowganda classed as Laurentian are granite and syenite, which are in large volume in the townships of Haultain and Van Hise. They are of pink and grey colour, and at times the granite grades into a syenite.

There is a tendency in some parts for the acid rocks to show indications of a gneissic structure, but banding and intense metamorphism, such as occur in the Laurentian in some localities, are not found. There is also the possibility that the granite and syenite may be of later age, say Algoman, but there is no way of deciding this point since no rocks of Timiskaming age occur in the area.

The most common variety is a hornblende granite, generally pink or flesh-coloured. A microscopic examination of a granite from west of Bloom lake shows a hypidiomorphic mixture of quartz, feldspar (orthoclase and acid plagioclase) and green hornblende with a little titanite, apatite and magnetite as accessory minerals. North of Everett lake and extending westerly to Davidson lake, the rock is more syenitic. Dikelets of the syenite intrude the Keewatin west of Everett lake.

Another common type is a grey biotite granite which is intermingled with the hornblende syenite.

There is a small area of porphyritic syenite in Nicol township, just northeast of Wilson lake. Where it approaches the basic Keewatin rocks it becomes darker in colour, with blotches of basic material which have been absorbed from the Keewatin. The porphyritic texture is well marked on the weathered surface where the phenocrysts have been bleached out. Zonal structure is pronounced in the crystals of feldspar, and is due to the regular arrangement of included minerals. The ferromagnesian minerals are green hornblende and a little biotite altering to chlorite; quartz is present in small grains.

Pre-Cobalt Series Dikes

There are numerous dikes of diabase that are at least older than the Cobalt series. They occur in profusion throughout the Keewatin area northeast of Gowganda townsite, east of Miller lake and elsewhere. These dikes have an approximate north and south strike. They are fresh-looking rocks, and except by their association are difficult to distinguish from similar-appearing dikes that occur in the Cobalt series and that occasionally intrude the Nipissing diabase. They generally contain some quartz grains, but on the whole are darker-looking than the quartz diabase of the sill. They show a somewhat rusty surface, whereas the sill diabase usually has a lighter-coloured oxidized appearance. Porphyritic texture is not uncommon in the dikes, with phenocrysts of feldspar varying from half an inch to three inches in length. Such porphyritic texture is not recognized in the diabase sill, and this criterion will serve to distinguish the dikes from the sill where only scattered exposures occur through the drift and relationships cannot be seen. The dikes occurring rarely in the Cobalt series and those that cut the diabase sill strike more nearly east and west than north and south. A number of north and south dikes intruding the syenite-porphyry, which is considered of Algoman age, were observed in the Matachewan area. No acid intrusive rocks that seem to be of Algoman age occur with similar dikes at Gowganda, but the north and south trend and nearness of localities together with the similarity of appearance suggest that the Gowganda dikes are probably also of post-Algoman age. This would place these dikes between the Algoman and Cobalt series in age, and younger than the basic intrusives called Haileyburian in the vicinity of Cobalt.

The dikes have no special characteristics, being of ordinary diabase consisting essentially of plagioclase and pyroxene, with or without inter-

stitial quartz. No olivine was observed in sections examined. Two porphyritic dikes are very striking in appearance, one on the transmission line, claim H.F. 209, and the other crossing the main road,, on claim T.C. 458, west of Leroy lake. The former of these is older than an adjacent diabase dike with similar north-south strike.

The dikes are not of economic importance as a source of silver since they are much older than the diabase sill. Considerable prospecting was done on them before their age relations were known. Unless in proximity to the sill the possibility of silver-bearing veins being found in them is remote. One of the most interesting localities where the dikes occur is on claims W. D. 961 and W. D. 964. Here they intrude a quartz-porphyry, or felsite, and iron formation, but are overlain unconformably by conglomerate of the Cobalt series. All these formations are intruded by a younger quartz-diabase dike that strikes a few degrees north of east.

Cobalt Series

The Cobalt series covers a great part of the Gowganda area, resting unconformably on the Keewatin-Laurentian complex and being in marked contrast with them. The series has been little disturbed, except where it is in proximity to the intrusive sill of diabase. The strata usually dip at low angles, averaging 15 degrees, for the most part eastward. Near the diabase they are frequently tilted to higher angles, as shown in the outcrop of slate-like greywacké on the easterly side of the high ridge of diabase east of Lost lake. A similar high dip in reddish slaty rock is seen northeast of Lake Irene. In these cases the sediments overlie the sill diabase. No secondary cleavage has been developed, the parting in the slaty varieties following the stratification.

The series includes conglomerate, breccia, greywacké, slate, quartzite and arkose. The lowest formation is usually a basal conglomerate that rests on the Keewatin and Laurentian. Many of the fragments of the conglomerate can be duplicated in rocks that occur in place in the vicinity. The pebbles and boulders include granite, syenite, greenstone, iron formation, diabase, &c.

Greywacké, which in places carries pebbles very sparsely and is occasionally quartzitic, occurs over most of the western parts of Leith, Milner and Van Hise townships. Conglomerate is seen at intervals along the west shore of Gowganda lake, on the south end of the long point on the lake, and frequently also east of the lake.

Freshly banded slate-like greywacké occurs southeast of Myrtle lake on the east side line of claim T. C. 156, and at several other points. It is often brecciated. This is well seen in the localty just mentioned where the slate is in a bluff dipping eastward. The top of the cliff is much brecciated, and overhangs the normal slate below it, which has crumpled away. Similar breccia is seen west of Frying-Pan lake, and on the government road a mile east of Lost lake. These occurrences are near the late diabase, and the brecciation may be due to the diabase intrusion. However, the occurrence near Myrtle lake lies above the contact with the diabase, with layers of undisturbed slate between.

Typical arkose and quartzite occur in great volume in parts of the area, particularly in the southeast portion, including parts of Nicol, Charters and Corkill. The large island on Gowganda lake is composed of quartzite. The arkose and quartzite are generally coarse-grained and thick-bedded, so that the dip is not always readily recognized.

About half a mile north of Wilson lake in Nicol township, the rocks of the Cobalt series dip gently to the west from the Keewatin. The succession is greywacké-conglomerate, slate, quartzite and an upper coarse conglomerate which resembles the conglomerate on the west shore of Gowganda lake. This succession of strata is seen in other parts of the area. Sometimes the greywacké-conglomerate, usually called slate-conglomerate, is underlain by a coarse basal conglomerate which resembles the upper conglomerate.

The latest of the sediments are quartzite and arkose which are sometimes underlain by a reddish slaty-greywacké.

The upper series has a widespread distribution southeast of Gowganda consisting of quartzite arkose and thin beds of quartz-conglomerate which, according to Barlow, have a thickness of 1,100 feet at Maple Mountain. Collins states that the thickness of the lower and upper formations of the series in its present greatly eroded state probably does not exceed 1,000 feet.

"Tower" hill, showing unconformity between conglomerate of the Cobalt series, and Keewatin.

The upper series of quartzite and arkose appears to be barren of economic minerals, but at certain localities it is intruded by sill diabase that carries silver-bearing veins.

Unconformities at base of Cobalt Series

Numerous unconformities between the Cobalt series and older rocks occur in parts of the area, a few of which are herewith described. There is a thin patch of conglomerate, with the underlying granite exposed in places through it, on the northwest shore of Obushkong lake. The conglomerate has rounded and angular fragments of the granite, and also a rusty-weathering diabase which cuts the Laurentian immediately at the contact.

An even more striking conglomerate occurs on claims W. D. 961 and 964 northeast of Gowganda lake. The high conglomerate ridge, on which is located the fire ranging observation tower, rests on a greyish-green quartz-porphyry, iron-formation and diabase dikes of pre-Cobalt series age. Fragments of all these rocks are found in the conglomerate, near its base.

North of Wilson lake, in Nicol township, there are patches of conglomerate on the syenite. The latter rock has a characteristic porphyritic texture, and fragments of it are quite numerous in the conglomerate. The presence of so varied a group of inclusions from rocks occurring in place near the conglomerate indicates that many of the constituents of the conglomerate were local, and not transported any great distance. The old Keewatin-Laurentian surface, on which the Cobalt series was deposited, seems to have resembled greatly in topography that of the present time.

Unconformity in Cobalt Series

In 1909, N. L. Bowen found an unconformity on the north line of H. R. 311, west of Obushkong lake, where greywacké and fine grained arkose show on a bluff about 12 feet in height. At the base of the arkose there are about two feet of a coarse reddish conglomerate containing some small pieces of greywacké which, under the microscope, prove to be the same as the underlying greenish rock, indicating a break in the normal deposition. A similar break was seen southeast of Flanagan lake, near the south line of claim H. S. 712. West of Gowganda lake, and on the long point extending into the lake, an upper conglomerate with a coarse reddish matrix occurs in considerable thickness. Similar conglomerate is seen in other parts of the area. The writer is not certain that the few feet of conglomerate below the arkose series on Obushkong lake is equivalent to all this coarse upper conglomerate. Where a great thickness of conglomerate occurs, a search failed to show any fragments of the underlying greywacké in it or many signs of an uneven and eroded surface.

It would appear that there is a local discontinuity in deposition at some points, but the general stratification and dip remain the same in the lower and upper parts of the Cobalt series. Owing to the widespread occurrence of the quartzite and arkose, it is possible to distinguish them from the conglomerate and slaty greywacké by different colours on the map, but the conglomerate, which appears to be part of the upper series, is difficult to separate, consequently it has been grouped with the other sediments apart from the quartzite and arkose. In the earlier reports on the Cobalt area the upper quartzite and arkose were called the Lorrain series. These rocks are similar to those at Gowganda.

Adinole

Where the sill diabase has been intruded into slate-like greywacke, the overlying rock has been sometimes altered by diabase to adinole. The rock occurs abundantly around Lost Lake, being reddish in colour and consisting principally of quartz and crystallized feldspar. Round blackish spots are often developed in the sediments near the contact. A rock of this description is seen along the road a mile west of Lost lake and on claim M.R. 2239 (O'Gorman) in Leith township.

Nipissing Diabase

The most important rock from an economic point of view is the fresh quartz diabase that occurs in the form of laccolithic sills over a great part of the Gowganda area. The resemblance of the outlying areas of diabase to the silver-bearing diabase sill at Cobalt led to the finding and prospecting of all such outcrops over a very wide area stretching from Cobalt to Shining Tree. The Gowganda area is only one part of this wider area in which isolated masses of quartz diabase have been discovered. Consequently, the diabase at Gowganda is similar to that at Cobalt, with the exception that at Gowganda there is a considerable development of the red facies of the diabase, known as granophyre or red rock, in addition

Top of diabase sill with overlying banded slate-like greywacké, exposed on claim G. G. 4108, north of Irene Lake.

to the normal dark-grey diabase. Numerous microscopic descriptions of the Nipissing diabase have been published, including those by C. W. Knight (1), N. L. Bowen (2), and W. H. Collins (3).

The rock is generally intermediate to coarse-grained, except at or near contacts where it may be fine-grained and trap-like in texture.

The principal minerals of the normal diabase are plagioclase, usually laboradorite or a feldspar near it in composition, together with augite, affording an ophitic texture. Generally primary quartz, either alone or in microscopic intergrowth with feldspar, is present in the interstices. From the almost constant presence of quartz in micrographic intergrowth with feldspar, C. W. Knight has referred to the rock as a

[1] Report, Ont. Bur. Mines, Vol. XIX, 1913 Part II, p. 98.
[2] Journal of Geology, Oct.-Nov., 1910.
[3] G. S. C. Memoir, No. 33.

quartz diabase. Small quantities of biotite and magnetite, and occasionally apatite and pyrite, are present. N. L. Bowen has found a subordinate pyroxene, which he believes to be enstatite, in sections from the Gowganda diabase. Ordinarily the diabase is of a dark-grey colour, weathering to a lighter shade, with brownish spots of weathered pyroxene showing on the surface.

This normal type of diabase is observed all across from the foot to the hanging-wall in the sill just west of Miller lake, with no red rock produced as differentiated material. The hanging-wall here is basic Keewatin.

In some places in addition to the grey feldspar there is red feldspar, imparting a mottled character to the diabase. The red is a more acid plagioclase and occurs with quartz in the interstices. This facies can be observed in places along the ridge west of Gowganda lake, e.g. at the Crews-McFarlan and Reeve-Dobie properties, along with the normal dark grey diabase.

Red Rock

A bright red to brown igneous rock occurs frequently with the normal diabase in several parts of the area. It is well exposed to the east and west of Lost lake. It resembles granite, but, owing to its prominent micropegmatitic texture, is called granophyre. Microscopically, it shows crystals of albite surrounded by a radiating intergrowth of quartz and acid plagioclase, together with small quantities of chlorite. The granophyre is so coarse-grained in some localities that the micrographic intergrowth can be recognized in hand specimens. This abundant granophyric rock occurs at the top of the diabase sill in the vicinity of Lost lake, at any rate where remnants of sedimentary rock can still be observed.

The origin of the red rock has been discussed fully by N. L. Bowen and W. H. Collins in the reports previously mentioned. In brief, Bowen believes the red rock, or granophyre, together with adinole, to have been formed by hydrothermal action at the contact on superincumbent slaty rocks. Collins states that most of the red rock has resulted from a differentiation of the diabase magma, with a small portion at the top of the sill being formed by assimilation of overlying greywacké and slate.

Certainly in the vicinity of Lost lake there is strong evidence of contact assimilation and at points it is difficult, if not impossible, to define the boundaries of the intrusive and the sediments.

Structure of Diabase

Miller Lake Area

Since the first examination was made by the author over ten years ago, repeated forest fires have devasted much of the Gowganda area so that parts have been burned off cleanly, affording many opportunities to note the relationship of the various rocks. Numerous contacts of the diabase with older rocks are well exposed in Haultain and Nicol townships. The sill character of the diabase can be determined from exposures showing both the bottom and the top of the intrusion.

Footwall Contacts.—The footwall of the sill outcrops at various points from the wagon road on claim H. J. B. 46, northerly to claim R. S.

C. 102, near Everett lake, where it swings eastward and northeastward to Shanty lake and beyond. The contact varies from nearly horizontal to 60 deg. Near Shanty lake the diabase overlies the slate-like greywacké almost horizontally, and on claim L. M. 108 it overlies Keewatin banded rocks, dipping 60 deg. N. One of the best footwall contacts occurs on Claim H. J. B. 46 to the south of th road, one and a half miles east of Gowganda lake. The diabase in thin isolated patches overlies the sedimentary rock nearly horizontally in places, with a general undulating dip to the northeast. Judging from the contacts along the footwall edge of the diabase, the sill was intruded very irregularly, only conforming to the dip of the sedimentary strata where they are highly stratified, e.g., the greywacké slate near Shanty lake. The attitude of the sill on claim L. M. 108 has been influenced by the highly banded, nearly vertical character of the Keewatin rocks.

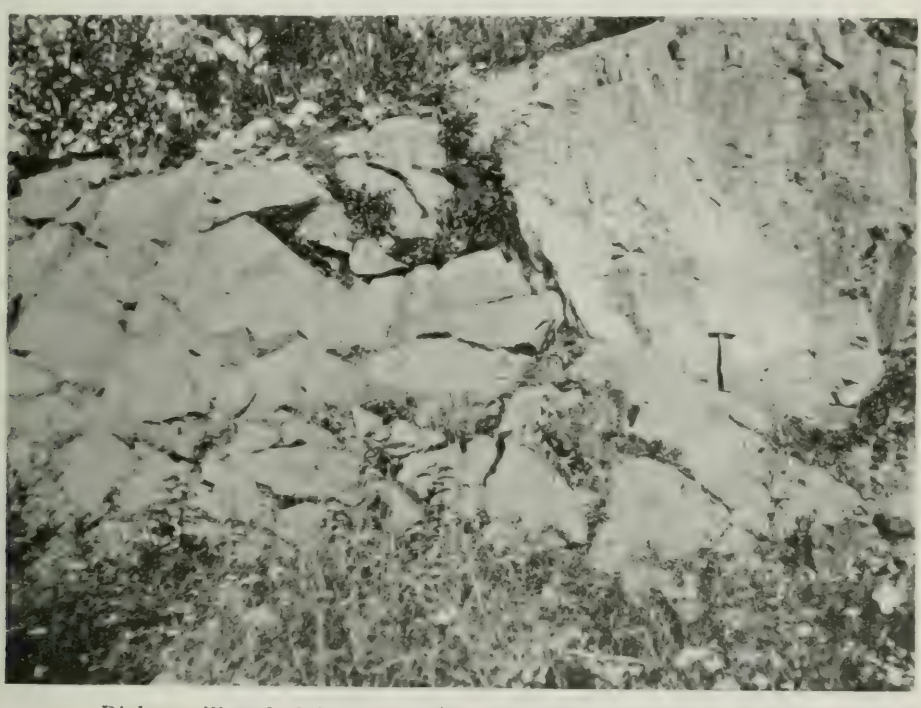
Diabase sill overlying Keewatin N.E. of Castle No. 2, near Everett lake.

Hanging-wall Contacts. —The observed contacts at the upper side of the diabase sill are even more numerous than the bottom. The upper contact is well exposed 100 feet west of No. 2 shaft, Castle mine, R. S. C. 101, on claims R. S. C. 95, 91 and 94 of the Miller Lake O'Brien mine, on R. S. C. 136 (Hart) claim, on claims W. J. 13 and W. J. 6, southwest and south of Leroy lake respectively, and on claim P. B. 140 southeast of Leroy lake.

The circular area of Keewatin rocks, overlain in part by the Cobalt series, occurring in the vicinity of Miller lake, rests on the diabase sill, and it is around this area that most of the contacts just referred to are located. The area of Keewatin and Cobalt series to the east of Leroy lake also lies on the sill, as do the greywacké and conglomerate around Lake Irene. To the east of Lost lake and extending northward to Bloom lake,

the diabase sill dips under the sediments of the Cobalt series. For this area the diabase sill has an undulating character, being exposed in places by partial erosion, and at other places concealed by the overlying Keewatin and later sediments. Westward, toward Gowganda lake, the sill has been entirely removed by erosion.

A great number of silver discoveries have been made in the diabase where it is in proximity to the contact with the overlying rocks; that is, in the upper part of the sill around the margin of the Keewatin-Cobalt series area in the vicinity of Miller lake. A few discoveries of silver have also been made in the overlying rocks.



Diabase sill underlying Keewatin, along road south of Leroy lake.

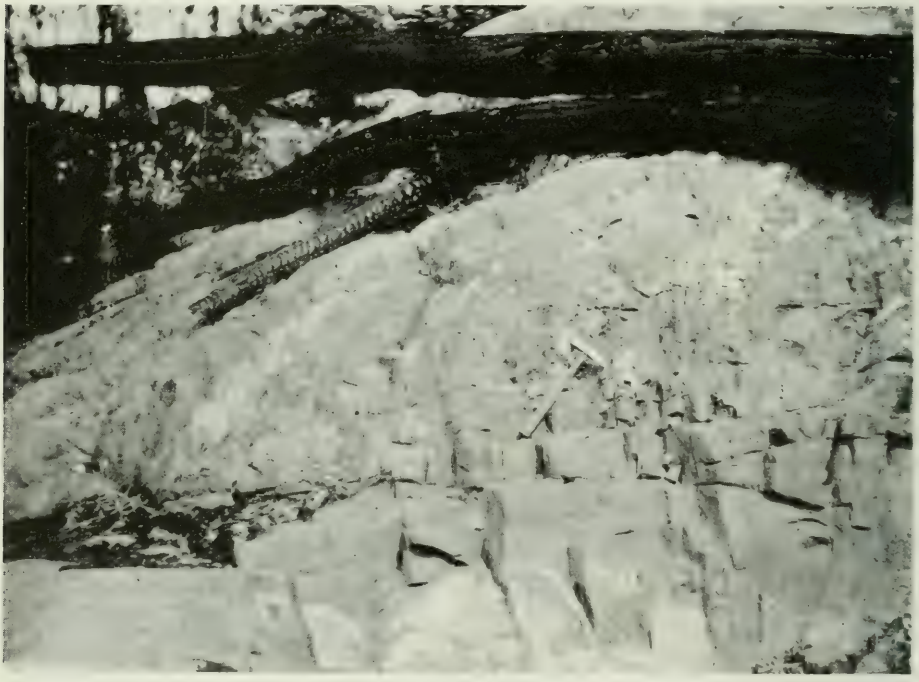
Columnar jointing in the diabase, representing structure at right angles to the cooling surface, is well developed at various places. It is particularly well shown in the cliffs on the Bonsall property, R. S. C. 83, also on claim H. R. 716, S. E. of Leroy lake.

The relationship of the sill diabase to the other rocks is illustrated in a number of cross-sections accompanying this report.

Area West of Gowganda Lake

A sufficient number of contacts have been observed to show that the various outcrops to the west of Gowganda are parts of one sill that has been exposed here and there by erosion of some of the overlying sedimentary rocks. Several ridges of diabase with a north and south strike and with intervening bands of sediment occur from the long point on Gowganda lake westward to Elkhorn and Spawning lakes. The intrusion of the diabase sill was not regular but undulating, principally eastward and westward.

The mass of diabase lying between the north and northwest arms of Gowganda lake dips under the sediment to the east and west. At the north end of this ridge, as shown on claim H. F. 250, the diabase sill rises and the footwall is exposed, showing a thin sheet of diabase on the greywacké. Remnants of the diabase sill occur to the west and north of Diabase lake. The westerly edge of the diabase sill is the hanging-wall side, and the conglomerate along the northwest arm lies on the sill, which is again exposed on the Mann ridge where good contacts of the sediments with the sill can be seen on the LaBrick and Hewitt properties. To the west of the south end of Gowanda lake the Mann diabase ridge divides into two parts. The easterly part dips under the conglomerate to the east, but overlies the quartzite to the west. The westerly ridge also overlies the quartzite, but dips westward under the greywacke that occurs around Long lake. The areas of sediment from Long lake northward to-



Diabase underlying Keewatin, S. E. of Leroy lake on claim P. B. 140.

Stuart lake all overlie the sill, which outcrops again near Elkhorn northward to Spawning lake.

No contact was observed along the westerly edge of the diabase with the greywacké near Margueratt lake, but it is believed that this edge is the footwall side of the sill, the conclusion being derived from the attitude of the diabase bluffs facing westward which show columnar structure inclined to the east.

From Elkhorn lake eastward to Frying Pan and Hangingstone lakes only one contact was observed, namely, on claim T. C. 129, and this indicated the diabase to be dipping under the greywacke at an angle of 60 deg. S. E.

The most convenient locality to observe contacts of the sill diabase with the sediments is Gowganda lake. Numerous contacts occur along the

east shore of the long point in Gowganda lake showing the sill below the greywacke. The best of these are on claims H. R. 292, and H. S. 377. On the latter claim there is a wide exposure of diabase from which the overlying greywacke has been removed by erosion simply to the contact, exposing the trap-like character of the diabase at the top of the sill.

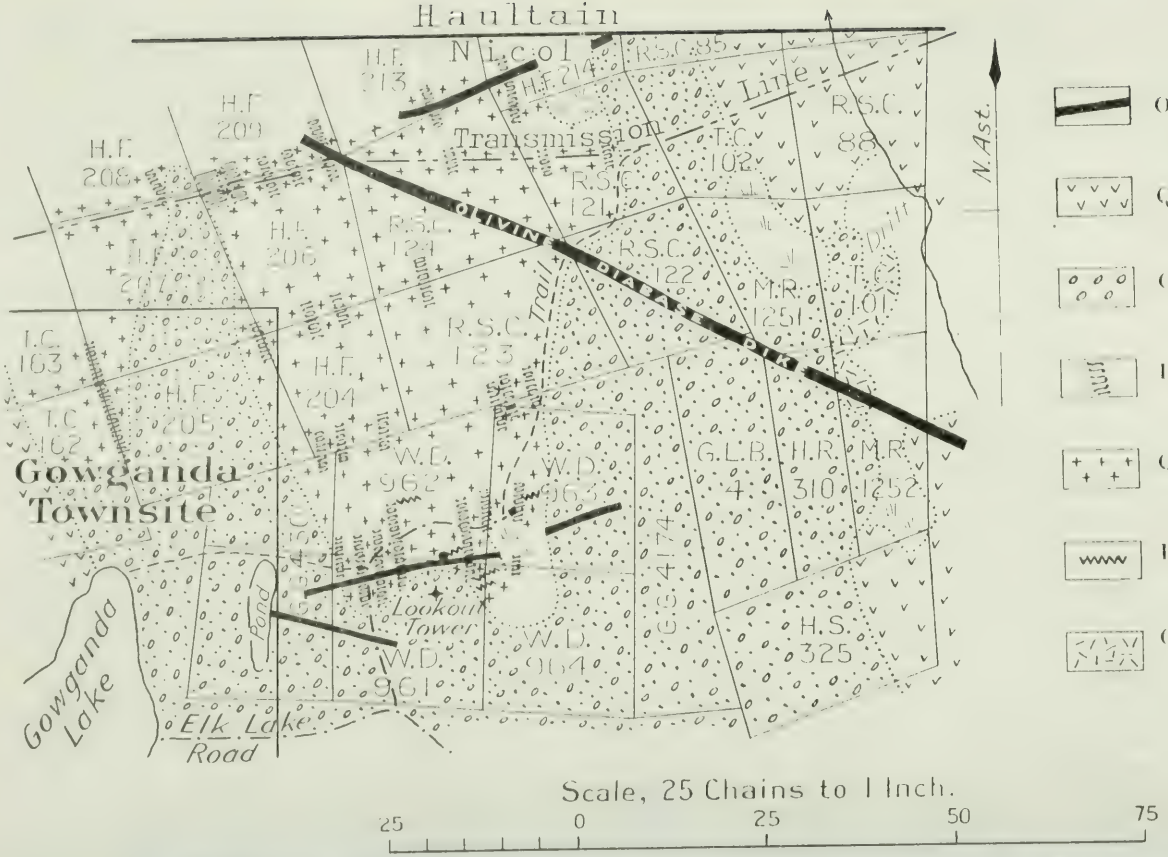
Good contacts occur also on claim H. S. 451 at the southwest end of the lake, where there is a thin sheet of sediment, a few feet thick, lying on the sill. Some adinole has been developed by contact metamorphism.

Remnants of diabase sill overlying quartzite on south side main road, 2 miles east of Gowganda.

Relations of Nipissing Diabase Areas

An examination of the map of Gowganda will show that the outcrops of sill diabase in the Miller and Lost lake area is separated from the area of sill diabase that lies west of Gowganda lake. Whether these separate areas of diabase are parts of one sill or represent two sills is not known. The topography to the north of Gowganda townsite shows a ravine from Gowganda lake northward to Dinny and Davidson lakes. The same depression can be followed southward by way of the east branch of the Montreal river. The sediments to the east and west of the depression are dissimilar.

The depression and dissimilarity of rocks could be explained by the possibility of a north-south fault in which the area west of the fault has been dropped. The ravine follows along the easterly edge of a long narrow ridge of diabase. Only one contact was observed along the east side, that being to the west of Davidson lake. The diabase-quartzite contact here is nearly vertical, the inclination, if any, being to the east. Along the west edge several contacts show the diabase overlying the quartzite at an angle of 45 degrees.



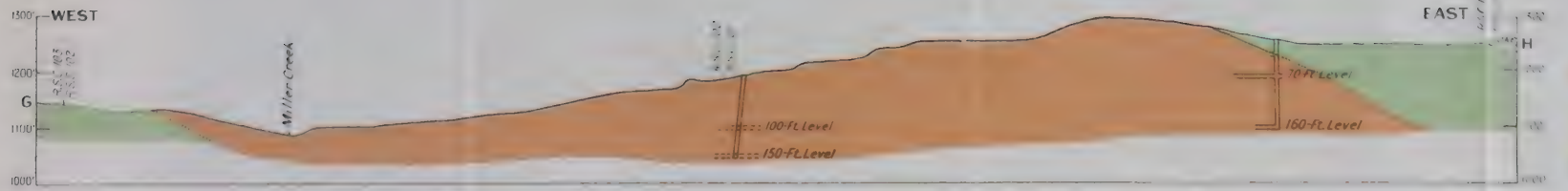
LEGEND

- Olivine diabase, quartz diabase dikes. *Intrusive Contact*
- NIPISSING
- Quartz Diabase *Intrusive Contact*
- COBALT SERIES
- Conglomerate *Unconformity*
- Diabase Dikes *Intrusive Contact*
- KEEWATIN
- Quartz Porphyry *Intrusive Contact*
- Iron Formation
- Greenstone

Scale, 25 Chains to 1 Inch.

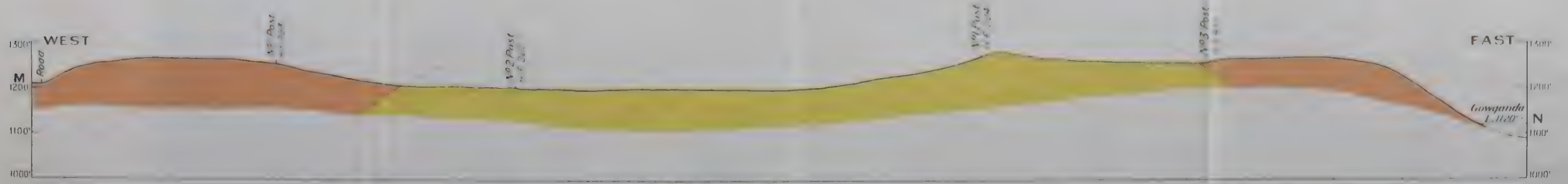
25 0 25 50 75

Geological plan of part of Nicol township, illustrating certain diabase dikes older than the Cobalt series, and others later than the Nipissing diabase.



Section on Line G-H. Scale: Horizontal and Vertical, 200 Feet to an Inch.

Section on Line J-K-L. Scale: Horizontal and Vertical, 800 Feet to an Inch.



Section on Line M-N. Scale: Horizontal and Vertical, 200 Feet to an Inch.

LEGEND

PRE-CAMBRIAN

Keweenawan (Nipissing)

Diabase sandstone

Animikean

Conglomerate and greywacke

Greywacke, conglomerate and slate

Keewatin

Greenstone, schist and porphyry

SECTIONS SHOWING RELATIONSHIP OF NIPISSING DIABASE SILL TO OLDER FORMATIONS AT GOWGANDA

To accompany report by A. G. Burrows in Volume XXX, Ontario Department of Mines Report, 1921

Dikes Later Than Nipissing Diabase

Olivine Diabase

Only one olivine-diabase dike was observed in the Miller lake section. This dike is about 100 feet in width and has been traced about five miles in a N.W.-S.E. direction. It intrudes all the other formations, intersecting the diabase sill that occurs around Miller lake. The dike is well exposed along the road on the ridge just west of the Canadian Gowganda property. The rock has a porphyritic texture, showing phenocrysts of light-greenish plagioclase up to an inch in length in an ophitic groundmass of plagioclase, augite and olivine.

A second olivine diabase dike occurs to the northwest of Obushkong lake and is described by N. L. Bowen (1) in an earlier report on the Gowganda Silver Area. This dike may be a faulted portion of that previously described.

Quartz Diabase Dikes

There are also several quartz-diabase dikes, that intrude the Cobalt series, whose relation to the diabase sill is unknown, and several that intrude the diabase sill. These are non-porphyritic, and have a more rusty weathered surface than the sill diabase. Two of these dikes, striking NE-SW, cross the Bonsall property, claims R. S. C. 83 and R. S. C. 84. Their relation to the silver-smaltite-bearing veins is not known. A calcite vein about 3 inches wide carrying masses of galena lies along the contact of one of these dikes with the sill diabase on claim R. S. C. 84. The pure galena carries 11.6 ounces of silver per ton.

Occurrence of Silver Ore

Silver-bearing veins have been found in widely separated areas from Cobalt westward to Shining Tree. Of the outlying areas Gowganda is the most important in discovery of veins and shipment of silver ore. Nearly all the silver deposits are in the Nipissing diabase which occurs in a number of townships around Gowganda lake. The most important townships are Haultain, Nicol and Milner from which a number of shipments of high-grade ore have been made. Silver has also been discovered in several other townships, including Leith, Van Hise, Charters, Lawson, Corkill and Morel. Small quantities of ore have been shipped from Leith, Lawson and Corkill townships.

In addition to those found in the diabase, a few silver-bearing veins have been discovered in the Keewatin greenstone, and the conglomerate of the Cobalt series. Where the discoveries have been made, these formations overlie the diabase sill and the veins are near the hanging-wall contact. In Gowganda no silver-bearing veins have as yet been found in rocks that lie below the diabase sill. At Cobalt most of the ore has been obtained from deposits, chiefly in conglomerate and greywacke, below the sill, which has been removed by erosion.

While a few places in Gowganda reveal the footwall rocks on which the diabase sill rested, most of the sediments and some of the Keewatin rocks are above the sill. The erosion has extended chiefly into the upper part of the sill, exposing it in more or less irregular and connected areas. An example of this is the sill of diabase in the Miller lake section which

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The Cobalt-Nickel-Arsenides and Silver Deposits of Temiskaming, Vol. XIX, 1913, Part II, Ont. Bur. of Mines Report, page 179.

rises toward the west, but eastward to Lost and Wigwam lakes it has several patches of older rocks overlying it. Discoveries of silver ore have indicated the desirability of prospecting the diabase and older rocks in the vicinity of the upper or hanging-wall contact, at least in the Miller lake section.

The workings at the Miller Lake O'Brien mine are all in the upper part of the diabase sill. The rich ore shoot at the Millerett mine, which was mined out several years ago, was in conglomerate that lay above the diabase sill. On the Castle property, R. S. C. 101, a high-grade vein discovered in 1920 was in Keewatin overlying the diabase sill, while operations later proved the vein to continue below the contact into the underlying diabase. Some rich ore was also encountered in Keewatin overlying the sill on the Silver Bullion property northeast of Leroy lake.

The silver-bearing veins at No. 1 shaft of the Castle property, R. S. C. 101, are in the diabase which has been eroded well down from the original top of the sill, and are apparently near the centre of the sill.

The veins at No. 1 shaft, Bonsall mine, are in the lower part of the sill, while those at No. 3 shaft are in the upper part of the sill near the upper contact with the Keewatin.

Silver ore has been found at several horizons in the diabase to the west of Gowganda. At the Boyd-Gordon and Mann properties the veins that produced the ore are in the upper part of the sill; the hanging-wall contact with the greywacké was encountered a few hundred feet west of the Boyd-Gordon shaft.

At Nos. 1 and 3 shafts of the Crews-McFarlan (formerly Bartlett) property, near the south end of Gowganda lake, work was done on several veins that are in the lower part of the diabase sill. The footwall here is quartzite, but the workings have not been carried at either shaft to the contact which can be seen on the surface to the east. The diabase from the bottom workings of No. 1 shaft is fairly fine-grained.

Origin of Silver Ore

Regarding the origin of the silver-cobalt veins at Cobalt, W. G. Miller remarks as follows:—

> The material in these veins has, in all likelihood, been deposited from highly heated and impure waters which circulated through the cracks and fissures of the crust and were probably associated with—followed—the Nipissing diabase eruption. It is rather difficult to predicate the original source of the metals—silver, cobalt, nickel, arsenic and others—now found in these veins. They may have come up from a considerable depth with the waters, or they may have been leached out of what are now the folded and disturbed greenstones and other rocks of the Keewatin. Analyses of various rocks of the area have not given a clue as to the origin of the ores. However, the widespread occurrences of cobalt veins in the diabase, or in close association with it, shown by discoveries during the last seven or eight years, throughout a region three thousand square miles or more in extent, appears to be pretty conclusive proof that the diabase and the ores came from one and the same magma.
>
> The waters are said to be associated or connected with the diabase eruption in the sense that they probably represented the end product of the eruption. In many volcanic regions hot springs are present long after the rocks have been solidified. In the Cobalt area the fissures and joints now occupied by the ores were probably produced by the gradual shrinkage in cooling of the diabase, the ores being deposited by the waters which represented the last stage of vulcanicity. (1)

(1) The Cobalt-Nickel-Arsenides and Silver Deposits of Temiskaming, Ont., Bur. of Mines, Vol. XIX, 1913, Part II, p. 8.

Veins

Certain characteristics of some veins in Gowganda, Elk Lake and elsewhere seem to point to a genetic relationship with the diabase. A number of the veins are aplitic in composition. The aplite is considered a differentiation from the diabase magma. Frequently the aplite grades into diabase along the walls; at other times it is sharply defined against the diabase walls. Some veins show aplite next to the diabase, followed by a layer of crystallized quartz, the crystals of which extend into the calcite which may occupy the centre of the vein. This type of vein frequently carries some native silver, smaltite and niccolite. The silver in the aplite and diabase is usually in thin scales or sheets. The occurrence of the diabase, aplite and quartz, successively, points to differentiation, while the calcite and the ores have come in later, probably from the same source. The aplite type of vein, however, varies greatly in the arrangement of the constituent parts, the calcite and ores often being irregularly distributed in the aplite.

Most of the veins are not aplite, but the chief gangue is calcite, frequently accompanied by some quartz; in fact, some silver-bearing veins carry considerable quartz. Some of the veins are quite narrow and interrupted, following the columnar jointing planes, and evidently represent the filling of cooling cracks after solidification and skrinkage of the sill.

Many veins are quite strong, and can be traced in a fairly straight course for several hundred feet. They sometimes occur in a series more or less parallel. Several parallel veins with strike N. 15 deg. E. were found on the Mann property west of Gowganda lake. Some of the parallel veins are sufficiently close to mine together. Veins of this character have been worked at the Miller Lake O'Brien and Castle mines.

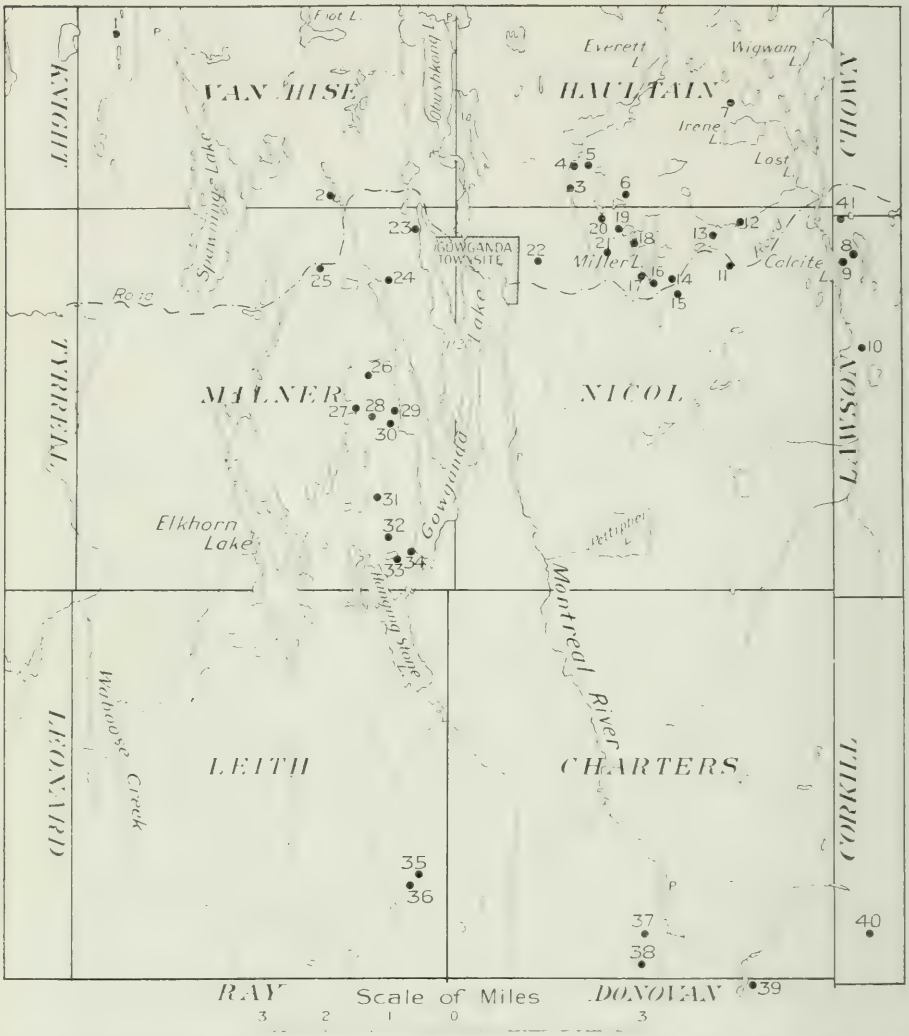
The veins vary greatly in width, and it would be difficult to state an average. The productive veins are usually from a fraction of an inch to 12 inches in width. Veins, however, occur that are as wide as two or three feet, but these are exceptional, and generally the wide calcite veins have not shown much value. One very strong vein, as wide as three feet in place, was found southeast of Miller lake. This vein, known as the Morrison, was traced for 2,000 feet across several claims. On claim T. C. 315 is showed some high-grade ore consisting of silver, smaltite, niccolite and native bismuth, over a length of about 8 feet along the surface.

A wide calcite vein, with east and west strike, occurs on the Miller Lake O'Brien property. This vein cuts a north and south silver-bearing vein.

Vein No. 7 at this property for a portion of its length showed a width of two feet of high-grade ore. The high-grade ore of No. 3 vein, Mann mines, varied from 1 inch to 5½ inches in width.

Several narrow veins with approximately the same strike sometimes unite to form one vein for some distance. Deposits of this character occur on the Miller Lake O'Brien and Castle properties. Where veins are parallel, one vein may carry ore, and an adjacent one may have little or no ore; while farther along in the workings these conditions may be reversed. Where several silver-bearing veins occur over a stoping width, the intervening wall-rock usually carries native silver in the form of thin scales or sheets in minute cracks which are generally roughly parallel with the veins. Even along a single narrow vein, there is generally a little leaf-silver in the rock adjacent to the vein.

A narrow calcite vein an inch or so in width may show segregations over a few feet in length of silver and smaltite entirely filling the vein, while the rest of the vein is calcite with dissemination of copper pyrites.



Map of Gowganda Silver Area, indicating the location of the principal Mines and Prospects

VAN HISE
1 Alpine
2 Hedlund

HAULTAIN
3 Bonsall
4 Everett
5 Castle
6 Symmes-Young
7 Barbara

LAWSON
8 Caleta
9 Bishop
10 Powerful
41 Sanderson

NICOL
11 Lafayette
12 Silver Bullion
13 Collins
14 Northern
15 Canadian Gowganda
16 Johnston
17 Hart
18 Walsh
19 Castle
20 Miller Lake O'Brien
21 T. C.
22 Big Four

MILNER
23 Gowganda Lake
24 Northcliff
25 Bishop
26 Hewitt
27 Boyd-Gordon
28 Mann
29 Milne
30 Silvers Ltd.
31 Reeve-Dobie
32 Crews-McFarlan
33 O'Brien
34 South Bay

LEITH
35 Silverado
36 Hudson

CHARTERS
37 Garvey
38 Haines

DONOVAN
39 Willans

CORKILL
40 Kell

Ore Shoots

As at Cobalt, it has been found at Gowganda that the high-grade silver ore occurs in shoots in the veins. A vein may be several hundred feet in length and show 50 feet, 100 feet or over of an ore shoot, or one only a few feet in length. A number of veins have shown a little native silver in places along them, but with no determinable ore shoots. The ore shoots vary greatly in size. The largest of these so far discovered were in the area northwest of Miller lake. An ore shoot in the conglomerate at the old Millerett property (now Miller Lake O'Brien) was about 150 feet long, averaging about two inches in width of high-grade ore, together with mill rock for about two feet on either side of the high-grade. Some ore shoots in the diabase at the Miller Lake O'Brien mine were several hundred feet in length. Ore shoots 75 to 80 feet in length are worked at the Castle mine. In No. 3 vein, Mann mine, several ore shoots were discovered and developed, varying from 35 ft. to 65 ft. in length. Extremely rich but short ore shoots were mined at the Reeve-Dobie.

These measurements refer to the length of shoots on the surface or in drifts. The pitch length of a shoot may be greater or less than the drift length. Near Miller lake the shoots are generally found to be longer on the pitch than along the drift.

Description of Mines and Prospects

While the geological examination was being made in 1920 there were only a few properties on which mining operations were being carried on. However, since a large number of properties have been worked in various years from 1908, it was thought advisable to give some description, where possible, of the work that had been done in former years.

Haultain and Nicol Townships

Bonsall.—The Bonsall property was among the earliest operated at Gowganda. It includes eight claims: R. S. C 82 to 89 inclusive, situated northwest of Miller lake. The first work was done on claims 82 and 83, on veins carrying native silver discovered by Percy Bonsall in 1908. Most of the silver and smaltite showed in a narrow vein averaging about one inch with strike N. 34 deg. E., which was traced for 100 feet by trenching. The surface of the vein was much oxidized, showing crystallized silver in black, cobalt and nickel, decomposition products. A shaft was sunk on the vein to a depth of 25 feet and a drift run northward.

A main shaft was later sunk on a cross vein that strikes nearly east and west, and varies from about one inch to four inches in width. This vein intersects the previously described vein 30 feet east of the shaft. A drift at the 25-foot level was made along the vein for 60 feet and on the narrower vein for 40 feet. High-grade ore of the character shown near the surface was not encountered. The rich ore was found to occur near the junction of the two veins. About 30 sacks of ore were taken out in 1909. The main shaft was continued to a depth of 125 feet with a north-south drift of 60 feet in a faulted zone on the 75-foot level and 186 feet of drifting and crosscutting on the 120-foot level.

The property was re-opened several years later by the Miller Lake O'Brien interests, who did considerable work at the lower level. A strong north-south fault, dipping 45 deg. E., and showing about 12 feet in width of fractured diabase, was encountered 45 feet east of the shaft. This fault

was also crossed at 60 feet in the shaft and would reach the surface in the bed of Miller creek. To the east of the fault the east and west vein was drifted on for 130 feet. The vein carries calcite with some quartz containing copper pyrites, galena and a little native silver. A second vein, 175 feet southeast of this vein, was drifted on for 26 feet. It showed low assay values in silver.

From March to July, 1920, the property was worked under the management of George Glendinning. The workings at the various shafts were de-watered, and the veins sampled at the several levels. At the main shaft, No. I., the work at the 120-foot level consisted in extending the drift on the main vein for 71 feet, and on the south vein for 108 feet with 23 feet of crosscutting. At the 75-foot level a crosscut was made eastward 33 feet to the vein, and 83 feet of drifting was done in a NE-SW direction. A raise was made at the intersection of the vein to the 25-foot level. This level was also connected with the open-cut. From these operations a quantity of silver ore was hand-sorted, bagged and shipped to Cobalt.

In addition to the operations at the main shaft some work has been done on the east side of the property, on claim R. S. C. 84. Two shafts were sunk by the early operators on silver-bearing calcite veins. The east shaft, 60 feet deep with some lateral workings, was found too wet for operating, and a second shaft was sunk to the 100-foot level on a narrow calcite vein, an inch or two in width, that showed a few segregations of silver and smaltite. The drift at the 100-foot level, 74 feet in length, showed the vein to carry a little silver and smaltite, similar to that on the surface. Several veins occur on the surface, but little work has been done. Owing to the favourable location of the veins in the diabase near the upper contact with the Keewatin, it would seem that this locality would warrant more extensive exploration.

The property is equipped with a plant at the western workings, consisting of two 50-h.p. boilers, a straight-line compressor and a hoist. A plant at the eastern workings was destroyed by a forest fire.

Miller Lake O'Brien.—The following is reproduced from the 29th Annual Report of the Ontario Department of Mines, 1920, Part III., pp. 81-84.

"The Miller Lake O'Brien mine comprises a group of claims to the northwest of Miller lake. They were formerly the Gates claims, on which discoveries of native silver and smaltite were made in 1908. Later the Millerett mine was purchased by the Miller Lake O'Brien Company. The first development was done on veins with a general north and south strike, lying near the line between claims R. S. C 90 (654) and R. S. C. 91 (653). Of these the most important were known as No. 2 vein system, which produced most of the ore in the early years of the mine. Development showed the veins of this system to dip steeply to the west, with the pitch of the ore-shoots to the south. Of this system, the footwall veins have been the most productive. The ore-shoot in the hanging-wall veins did not extend to the 140-foot level, whereas the footwall ore body continued nearly to the 350-foot level. Each of these series carried two or more veins, which were sufficiently close together, where the ore-shoots occurred, to allow mining in one stope. The veins were generally from two to five inches wide, and in the ore-shoots individual veins were not always productive, but where one was barren, a parallel vein would carry high-grade ore. Very little ore was taken from this system above the

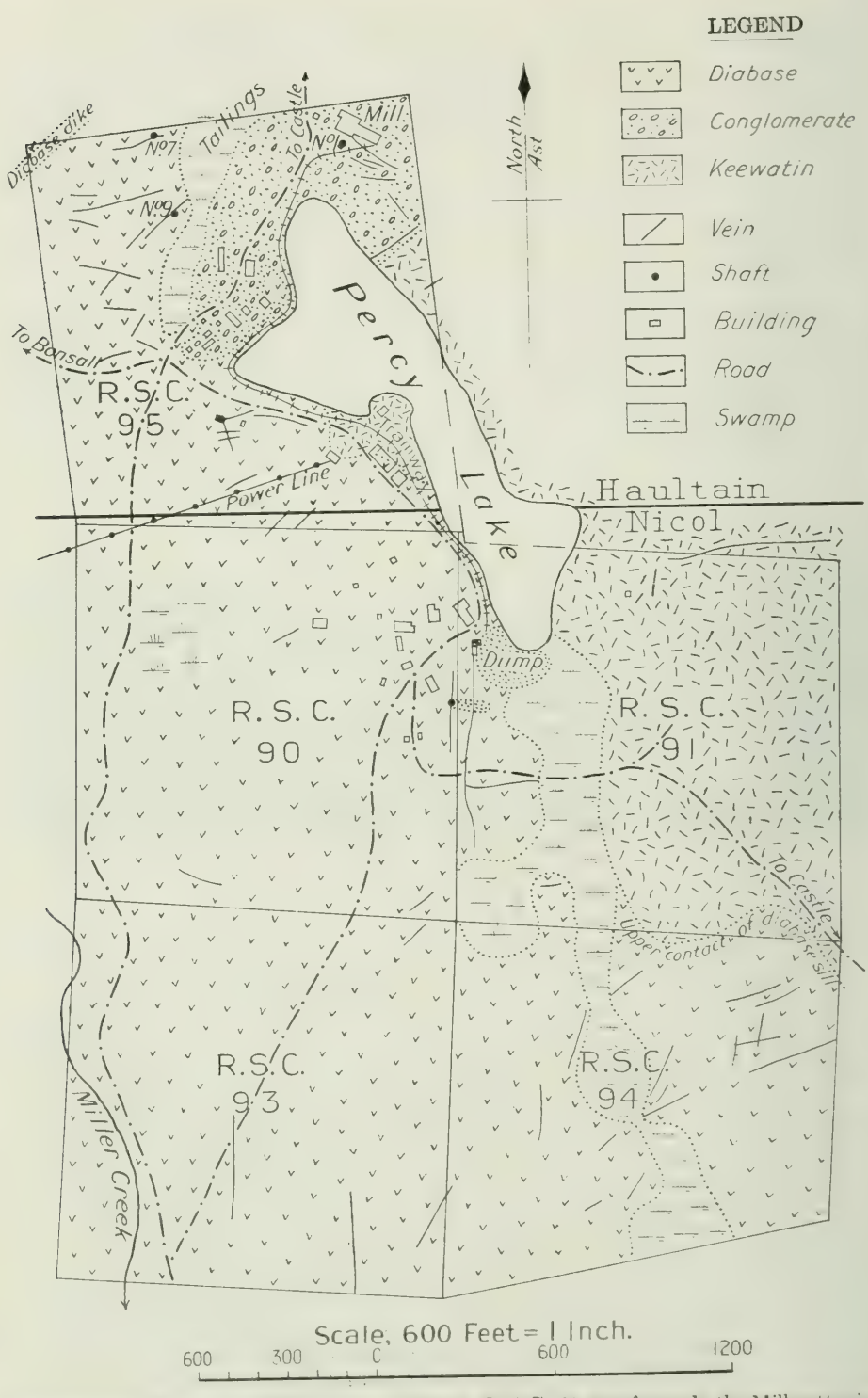
60-foot level. The greater proportion of the silver values was confined to the veins themselves, there being only a small impregnation of the wall rock. Strong east and west faults dipping 30 deg. north were encountered in the workings on No. 2 system. In developing this vein system a series of cross-veins was encountered south of the shaft, on the 250-foot level, having an east and west strike. This series of veins is known as the cross-system, and dips to the south at a high angle. An ore-shoot was found on the 250-foot level, and was stoped a short distance above the 140-foot level. It was followed down below the 400-foot level with decreasing length along the drifts.

"The latest discovered ore system is known as the 'Flynn.' The first ore was encountered on the 350-foot level. A long east and west drift had crossed a very pronounced north and south fault, (c) dipping 50 deg. east, and a northerly cross-cut had intersected No. 6 vein, which was followed by a second fault, striking east and west and dipping 30 to 40 deg. to the north. Ore was found in No. 6 vein above this fault. From this discovery the development was extended to a number of veins, the principal of which are No. 6, No. 7 N., No. 7 N.W., etc. On stoping No. 6

Miller Lake O'Brien mine.

above the 350-foot level it was found to join No. 7 N., producing the greatest width of high-grade ore found in the mine, where one portion of the vein was three feet wide, of high-grade silver, smaltite and calcite. Later, in drifting on No. 7 vein on the 350-foot level, portions of it were of high-grade ore two feet wide. In this rich section of the 'Flynn' system, the stope was 14 feet in width, in places of high-grade veins and mill rock. Development in this part of the mine threw light on the ore relationships. The workings show that the high-grade values did not extend into the Keewatin, while in that formation the veins themselves became more indefinite, branching into stringers carrying galena, copper pyrites and other common minerals. The contact as determined at a few points in different parts of the mine dips from 20 deg. to 30 deg. (with the sill diabase below the Keewatin greenstone) gradually flattening.

"Development has proven the aforementioned east and west fault to be generally the lower boundary of the ore. The veins carrying the ore are said to have been only slightly displaced by the fault. One vein, No. 7 N.W., was observed to have been faulted about three feet. In this vein the east and west fault is not the lower boundary of the ore, since ore was being stoped from it on the 400-foot level below the fault. The ore occurs



Surface plan of Miller Lake O'Brien mine. Claim R.S.C. 95 was formerly the Millerett mine.

in the diabase below the Keewatin greenstone, while the main ore-shoots pitch to the north, being controlled by the Keewatin-diabase contact and the east and west fault, the ore not necessarily coming close to the contact. In developing vein No. 7 N., which carries the principal ore body, an inclined winze (87 deg. W.) has been carried from the 350-foot level to the 525-foot level, and the ore from this and other veins is developed from the several levels.

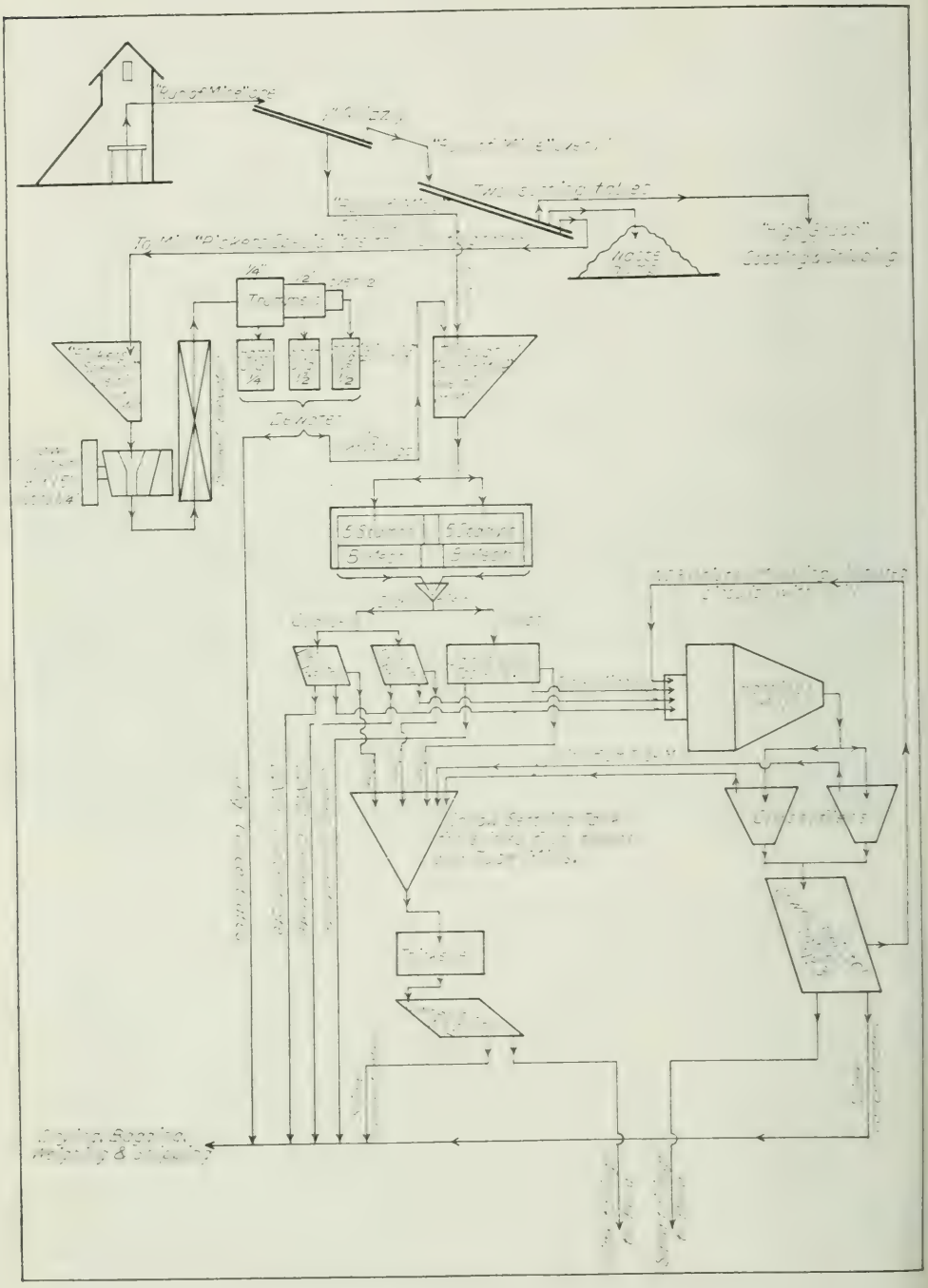
" Development at this mine on R. S. C. 90 and 91 has shown all the ore so far to be in the diabase. The early workings at No. 2 vein system were in the diabase, which outcropped at the surface, where only a small portion of the sill had been eroded. Later work being in the diabase below the Keewatin, it has been determined that silver ore occurs at greater depth from the present surface, depending roughly on the Keewatin-diabase contact. The silver ore occurs in the upper portion of the diabase sill in proximity to the contact.

Part of Miller O'Brien mine, showing mill.

" The treatment of the ore is shown by the flow sheet diagram, page 28. The ore, after passing through the high-grade and water-sorting treatment at the main shaft, is hauled in trains of 2-ton cars to the incline at the mill by a gasoline motor. The cars are drawn up the incline singly by a hoist to the mill ore bin. About 35 tons of ore are treated daily in the mill. The mill was operated originally by the Millerett Mining Company, and is situated about a quarter of a mile north of the main shaft.

" Power for the mine and mill is supplied by a hydro-electric development at the foot of Gowganda lake. The natural fall is 27 feet, but by a dam is raised to 30 feet and the installation is capable of developing 500 horse power. The transmission line is 2¼ miles in length and the voltage 4,000. About 300 horse power is required for the mine and mill; in dry seasons, owing to the lack of storage, this requirement is not always met."

During 1920 operations were continued on the series of veins in the Flynn system. A new vein, No. 16, carrying native silver, which lies 25 feet west of the north part of the main vein, No. 7 N., was discovered and drifted on for 140 feet on the 460-foot level. This vein lies above the



Flow Sheet, Miller Lake O'Brien mine.

strong north-south fault C. which dips 50 deg. E., and the ore-shoot in this vein, as well as N. 7 N.W., was not located below the fault. Further work was done on vein No. 7 N.E., in which ore was found on the 525-foot level below the prominent east-west fault, called the ore fault, which in several veins terminated the downward extensions of ore shoots.

J. G. Dickenson of Cobalt is general manager, and H. G. Kennedy is resident superintendent.

Specimen of polished ore from Miller Lake O'Brien mine, showing fern-like structure of crystallized native silver and smaltite (white) and crystallized smaltite (light grey) in calcite gangue (dark grey.) Some of the silver occurs in minute veinlets in the calcite and smaltite.

Symmes-Young.—This property, H. S. 351, is located about a quarter of a mile north of Miller lake. The outcrops show conglomerate and greywacké of the Cobalt series overlying Keewatin greenstone. These formations overlie the diabase sill that outcrops nearly one-half a mile to the west, and has a gentle dip to the east. Two hundred feet west of No. 1 post there is a strong smaltite-niccolite vein that strikes approximately north and south. It crosses the line to claim H. S. 350, being traceable on both properties for about 700 feet, and is in the conglomerate-greywacké. A shallow shaft about 44 feet in depth has been sunk on claim H. S. 350, fifteen feet north of the line. The vein had a maximum width of a foot when the shaft was located, but diminished rapidly to the north and south and also in the shaft. In places there are several narrow veins running from an inch to three inches in width. At 30 feet in the shaft there are several veins in a width of 15 inches. The walls of the shaft are stained with pink and green arsenates. At the bottom of the shaft the rock is greywacke, the Keewatin not having been penetrated. The ore is smaltite-chloanthite and niccolite intimately intermixed. It carries less than one ounce of silver per ton. A sample of the grey smaltite-chloanthite examined by J. A. Reid contained 12.44 per cent. of cobalt and 13.31 per cent. of nickel. The depth of the diabase sill below

the Keewatin and Cobalt series is not known, but the vein contents in all probability have been derived from the diabase sill magma.

Haultain Township

Castle (R. S. C. 101)—Claim R. S. C. 101, which is one of a number of claims of the Castle group situated about half a mile south of the west end of Everett lake, has been operated continuously by the Trethewey Silver-Cobalt Mine, Limited, since the fall of 1919, when trenching near the west line of the claim revealed some narrow veins carrying high-grade silver ore. The veins are continuations of fractures that were worked several years previously on claim R. S. C. 102 by the Miller Lake and Everett Mines, Limited. They strike approximately N. 30 deg. W. and dip 85 deg. SSW. As shown near the surface, the ore deposit consisted of a series of closely spaced calcite and quartz veins over a width of 18 inches. In sinking the shaft the veins were found at times to unite into fewer and wider veins, a width of 5 inches of high-grade ore being occasionally encountered. The high-grade ore averaged about three inches in width. The chief vein-filling is calcite, but quartz is abundant. Native silver, smaltite, copper pyrites and specularite occur in parts of the veins. Where there are several narrow veins, one may carry ore and an adjacent one be practically barren at the same horizon; while the values may shift from one vein to another on further working. The diabase adjacent to the veins frequently carries leaf silver, sometimes in short heavy sheets. The ore shoot has been developed by means of a shaft to the 150-foot level. At the 100-foot level the shoot is about 80 feet in length, the shaft being located near the centre of the shoot, which pitches nearly vertically. Two stopes, 25 feet in length, were opened 10 feet from the shaft on the 100-foot level, and carried toward the surface. A third stope was opened southeast of the shaft at the 150-foot level. The broken ore and rock from the stopes is passed over picking tables, and the ore sorted from the waste and mill rock. With the high-grade from the veins and the higher-grade wall rock a product is obtained averaging approximately 1,000 ounces to the ton. The mill rock is accumulated on the dump for possible future treatment.

Exploratory work was also carried on at the 100-foot level, a series of veins having been drifted on for 350 feet southeast of the shaft. A northwesterly cross-cut intersected a wide calcite vein, but no exploratory work was done on this vein. Several strong veins outcrop on the southwest part of the claim, but underground work on the 100-foot level was not carried to their probable underground extension.

The ore shoot just described is probably located toward the centre of the sill, as indicated in the accompanying cross-section, in which respect it differs from the more recently discovered ore shoot on the east part of the property. This ore shoot occurs in Keewatin greenstone at and near the surface, and has been proven by exploration to pass into the underlying diabase sill, the contact of which with the Keewatin is exposed at the surface about 100 feet west of No. 2 shaft. This high-grade vein was discovered by Tom Garvey, a prospector, in the spring of 1920. The vein strikes nearly east and west magnetic, and dips 80 degs. to 85 degs. N. An open cut about 30 feet long was first made along the ore shoot from which some high-grade ore was extracted. Oxidation extended downward several feet and loose fragments of native silver up to 15 inches in length were taken from the black decomposed cobalt oxide. The fresh ore is smaltite and native silver in calcite. The bottom of the open

cut showed in places a width of three inches of high-grade ore. Several sacks of silver in loose pieces were shipped from the open cut.

To develop the ore shoot a vertical shaft has been sunk at its eastern end, the vein being intersected at several levels by cross-cutting. The contact between the Keewatin and the Nipissing diabase was encountered at a depth of between 25 and 30 feet. As the Keewatin rock is a fine-grained diabase, or basalt, the exact location of the contact is difficult to determine without microscopic examination of the rock. The Keewatin rock contains much hornblende and may be called a hornblende diabase.

As already stated, the high-grade ore shoot was found to continue from the Keewatin into the sill diabase, shown in the sub-drift at the 30-foot level. After entering the diabase, the vein was succeeded by a second overlapping vein 15 inches to the north, in which the high-grade ore continued downward. In the drift the vein shows in places two inches of high-grade ore with some leaf silver in the wall rock. The vein was also cut at the 70-foot level where the ore shoot was encountered a few feet north and west of the shaft. The drift at this level is reported to follow the ore shoot for 75 feet. When first encountered two veins were shown in the face, a narrow vein about $\frac{1}{4}$-inch in width accompanying the main vein, which was one to two inches in width. Both veins were faulted four inches to the north by a horizontal fault carrying calcite. This flat calcite vein, near the intersection of the nearly vertical veins, carries some secondary ruby silver. By February, 1921, the shaft had reached the 160-foot level. In sinking from the 70-foot level a second vein was encountered in the shaft at 105 feet on the south wall, and followed 125 feet, where it left the shaft on the north wall. This vein averages one and one-half inches in width and is high-grade.

A cross vein, showing some high-grade silver ore near the junction with the main vein, was also encountered in the open cut at the east end of the ore shoot. It dips steeply to the west and also shows west of the shaft at the 30-foot level. Its junction appears to limit the ore shoot to the east.

The property is equipped with a power plant at No. 1 shaft, consisting of two locomotive boilers, a three-drill compressor and two hoists. A third boiler has been altered to an air receiver at No. 2 shaft to which air is piped from the power plant.

Murray Kennedy is manager and Neil Morrison superintendent of the property.

Miller Lake and Everett (*R. S. C. 102*).—This property, lying to the west of R. S. C. 101, was operated some years ago by the Miller Lake and Everett Mines, Ltd., and 8.35 tons of silver ore were shipped in 1910. The ore was taken from a long open cut on a series of silver-bearing veins striking north 35 degs. west. The ore was hand-sorted, and there are a few tons of mill rock on the dump at present, where fragments of diabase frequently show scales of native silver. Fissuring is pronounced on claims R. S. C. 101 and 102 in the vicinity of the north and south centre line.

Barbara.—During parts of 1915 and 1916 some exploratory work was done on the Barbara property, situated to the north of Lake Irene. Several veins of quartz and calcite show on the surface. A strong vein on claim S. W. 8, striking N. 15 degs. E., has been trenched for several hundred feet, and consists of calcite and quartz, from an inch to two inches in width, carrying copper pyrites and bornite. A little native silver

shows in seams in the very coarse, gabbro-like diabase. A shaft was sunk to the 100-foot level, and some crosscutting done on the level to intersect veins. The veins are located well within the diabase sill. The sedimentary rocks, one-quarter of a mile south around Lake Irene, lie on the sill.

Some smaltite and silver occur in veins on claim S. W. 18, south of Lake Irene.

Nicol Township

Big Four.—The Big Four consists of four mining claims, W. D. 961 to 964, situated one-half mile northeast of Gowganda lake. There is a great assemblage of rocks, consisting of Keewatin iron formation and green schist, quartz-porphyry, older diabase dikes, Cobalt series conglomerate and later diabase dikes. The diabase sill is not exposed on the property.

A vein, carrying calcite, cobaltite, iron pyrites and galena, was found on claim W. D. 962. It strikes N. 14 degs. E. and dips 30 degs. E. An open-cut about 20 feet in length was made along the vein, disclosing a width of 5 to 6 inches of material carrying much bloom and cobaltite. This showing is cut off by a diabase dike to the south. To the south of the dike, which is 50 feet wide, there are also some small showings of bloom. The vein or lens carrying the cobaltite occurs in iron formation, here represented by a silicious rock resembling chert, which for four feet above the vein is much stained with iron rust. A sample from the vein carries no gold and 8 ounces of silver per ton. A shaft sunk at a point 50 feet east of the outcrop of the vein intersected the low dipping vein which showed the same mineralization.

Some prospecting was also done on rusty silicious iron formation three chains northeast of the shaft. This work indicated a mass of solid iron pyrites in the iron formation lying between two north-south diabase dikes 9 feet apart and having a footwall of quartz-porphyry dipping 60 degs. N. Toward the north the iron pyrites, about 6 feet wide, becomes leaner, grading into silicious iron formation. The area immediately beyond the two dikes of diabase is drift-covered, and may conceal the extension of the sulphide band. A sample of the iron pyrites carries 41.35 per cent of sulphur. The silicious iron formation, carrying disseminated iron pyrites, contains no gold.

Castle, R. S. C. 106 and R. S. C. 92 (652).—Considerable exploratory work has been done on these claims by the Trethewey Silver-Cobalt Mine, Limited, with a view to prospecting the diabase formation which occurs beneath the Keewatin. These claims are situated just northwest of Miller lake.

A shaft was started in Keewatin on claim R. S. C. 106 and sunk to the 300-foot level. The diabase was first encountered at 90 feet, and from this depth to 130 feet the shaft was partly on both formations, showing a nearly vertical contact for this distance. Below this the shaft was entirely in the diabase, and a cross-cut 400 feet in length to the north of east was run to the contact, indicating a general dip of contact of 20 degs. from 130 feet in the shaft. The contact was further ascertained, in a long drift extending 500 feet to the north of the cross-cut, to be 15 N.E. Consequently at this horizon the diabase dips gently under the Keewatin. A calcite vein, striking north and south and dipping steeply to the west, was discovered 130 feet from the shaft, and drifting on the

vein for about 230 feet has been done on the 300-foot level, and also on the 360-foot level, which is connected with the upper level by a steeply inclined winze on the vein. This vein carries in places some native silver together with smaltite, niccolite, native bismuth, copper pyrites and pyrite, and some quartz. Several strong faults dipping 30 degs. N.E. were encountered in the workings. One of these displaced the vein 20 feet on the 300-foot level. Several other calcite veins were also discovered. One of these showed a width of six inches in a cross-cut west from the main vein, while another was encountered 400 feet from the shaft in the long cross-cut, near the Keewatin contact. This vein of calcite up to four inches wide carries some smaltite.

Chapelle Claim H. R. 715 (*195*).—This property lies to the east of Leroy lake, including part of the lake. The rock exposed on the surface is nearly all sill diabase, with a small amount of Keewatin near the northeast corner post. In October, 1919, C. L. Campbell and W. H. Fairburn, who had optioned the property, began work on it by continuing the sinking of a shaft that had been begun some years before. This shaft is on a strong aplite dike and calcite vein. Some high-grade silver ore was encountered by the former operators at 48 feet, and again in the drift at the 85-foot level. Small amounts of silver had been found frequently while sinking the shaft and running the drift. Exploration showed that the vein, which strikes south 20 degs. west when drifted on to the south, was faulted 55 feet to the southeast. This fault which dips 60 degs. northeast contains drag vein material and also that of an aplite dike. In the face of the drift beyond the fault, there is a 4-inch vein of calcite and two mineralized aplite dikes of 1½ and 4 inches respectively. Specimens on the dump show calcite and aplite with copper pyrites, bornite, iron pyrites, and some smaltite and niccolite.

A number of veins were located on the surface by means of trenching in previous years, but most of these are now concealed by sand filling in the trenches. These veins occur in the diabase, which rises as a sill from the northwest, having the same relation to the Keewatin area northwest of Leroy lake as the diabase to the northwest of Miller lake, that is, it dips under the Keewatin. Owing to trouble over the option, work was discontinued on this claim in November, 1919.

Collins Claim (*T. C. 220*).—This claim, on the west side of Leroy lake, shows exposures of Keewatin tuffs and greenstone intruded by dikes of diabase. The Keewatin rocks, where banded, strike N. 60 degs. E. A vertical shaft, started on the east contact of a diabase dike with banded tuff, where there is a vein of calcite with quartz, copper pyrites, iron pyrites, and some smaltite and niccolite, has been sunk to the 300-foot level. A station was cut on the 180-foot level, also at the 300-foot level, where exploration will be carried on.

The vein on the surface is somewhat lens-like, and is four inches in width 100 feet south of the shaft, being located in places along the contact with the diabase. It was found to dip from the shaft at 50 feet; below 80 feet the shaft is entirely in the diabase dike. At 165 feet a second vein was encountered, averaging four inches in width and dipping from the shaft at 180 feet. Some native silver is reported to have been found in this vein. Distant 375 feet north of the main shaft, there is another shaft 20 feet in depth on the west contact of the diabase dike, where a vein about three inches wide contains minerals similar to those previously mentioned; native silver is found occasionally in this vein. The area of Keewatin overlies the diabase sill that outcrops on the east side

of Leroy lake and to the south along the road. The bottom of the 300-foot shaft should be near the contact with the diabase sill provided the dip is approximately 30 degs. W., as indicated at the surface. F. H. Collins is manager.

Hart Claims.—The Hart claims, R. S. C. 135 and 136, were under option for a part of the year 1920. This property is favourably located along the hanging-wall contact of the sill diabase with the Keewatin, the sill outcropping on the southerly claim and the southwest part of the northerly claim. A shaft was sunk to the 100-foot level on a strong calcite vein. The vein strikes N. 23 degs. E., is nearly vertical and averages about four to six inches in width. Masses of vein material from the drift show abundant copper pyrite, bornite and pyrite. A little silver is reported from the vein. When visited in September, 1920, the drifts had reached 80 feet and 25 feet, north and south of the shaft respectively. A number of calcite veins are exposed on the surface.

Silver Bullion.—The Silver Bullion property is situated at the northeast end of Leroy lake. It includes two claims on each of which a shaft has been sunk. The easterly claim, W. J. 1, formerly called the Dodds, contains outcropping of schistose Keewatin greenstone. Near the south line of the claim a vein, carrying native silver, smaltite and native bismuth, with strike nearly east and west, was discovered. An open-cut was made on the vein by former operators, the cut being carried to a flat slip beyond which no work was done. A few bags of silver ore were taken from the open-cut. Further work by the Silver Bullion Company showed the lower extension of the vein to be faulted four feet to the north. A shaft was put down on the vein to a depth of approximately 50 feet by means of hand steel. The work showed a succession of faults and slips, the vein being displaced a few feet north or south, with the greater movement to the north. The greatest throw is at the bottom of the shaft where the lower part of the vein is displaced six feet to the north. At 30 feet in the shaft the vein is six inches in width. Segregations of silver, smaltite, niccolite and bismuth were encountered in the calcite vein. A plant, consisting of a 100-h.p. boiler, a 6-drill compressor and a 6 x 8-inch hoist, was installed in the fall of 1920. The property was closed down shortly after, but it is expected operations will be resumed early in 1921.

The shaft on the westerly claim is located on a small island where there is an outcropping of Keewatin. It was sunk 100 feet, and the area under the lake was prospected by a cross-cut to the south. A two-inch vein of calcite was encountered 90 feet to the south of the shaft. This vein showed a little smaltite. The shaft was abandoned for the new shaft on the Dodds vein. R. C. Gamble is manager of the property.

Walsh.—The Walsh claim (R. S. C. 98) includes a small portion of the shore of Miller lake and takes in some land under the lake itself. During parts of the years 1917 and 1918 the property was under option to the Crown Reserve Mining Company. A shaft previously sunk 60 feet deep was continued to 200 feet. It is located on the south part of the claim, near the shore of the lake. From the shaft drifts were run northward on the 100- and 180-foot levels. A little silver ore was indicated on the 100-foot level. The calcite vein is said to be strong on both levels.

During the first part of 1920 the Walsh Mines, Limited, reopened the mine and continued prospecting, chiefly on the 180-foot level, but the result was not very encouraging. The drift was extended to the contact, where the Keewatin was found to overlie the sill diabase at an angle of

35 degs. E. The geological conditions would seem favourable for prospecting the diabase below the Keewatin, since the work has indicated some silver deposition.

The shaft was started in a north-south diabase dike, about 30 feet in width, that intrudes the Keewatin schist. The dike carries some phenocrysts of feldspar, and is believed to be of pre-Cobalt series age. It also carries some calcite veins with north-south strike. Both the dike and the Keewatin intruded by it overlie the diabase sill, but the depth in the shaft at which the sill was encountered is not known, as the workings were filled with water at the time of visit and no examination could be made.

The property is equipped with two 40-h.p. boilers, a small compressor and hoist and has good camp buildings.

Lawson Township

Considerable exploratory work has been carried on at various times on properties in the vicinity of Calcite lake. During 1920 none of these properties was in operation.

Bishop.—The Bishop Mining Company operated mining claim L. O. 313, adjacent to the east shore of Calcite lake. As the shore of the lake is precipitous, it was possible to carry on exploration by means of an adit level eastward into the ridge. The adit is 515 feet long and at 216 feet from the portal, north and south drifts, 464 feet and 177 feet respectively, were made on a calcite vein, which showed a little silver ore here and there but no continuous ore-shoot.

No. 1 winze, 300 feet from the portal, is 18 feet deep, and No. 2 winze, at the end of the main drift,is 100 feet deep with 100 feet of work at the lower level.

The plant consists of two 60-h.p. boilers, a 6-drill compressor and hoist.

Caleta.—Mining claim L. O. 357 was first operated by the Calcite Lake Mining Company, and later by the Caleta Mining Company. The Mining Inspector's report for 1914 states that shaft was sunk 285 feet with 340 feet of cross-cutting and 310 feet of drifting, mainly at the 200-foot level. Some native silver, smaltite and niccolite in calcite were encountered in the workings and a small shipment of silver ore made from the property.

The plant consists of two boilers, 40-h.p. and 60-h.p., a 3-drill compressor and an 8 by 10 hoist.

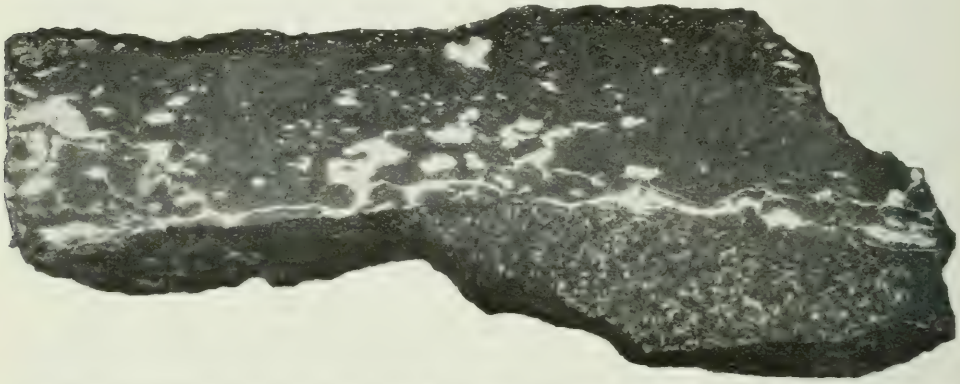
Powerful.—The Powerful prospect is situated about one mile southeastward from Calcite lake. The property has been worked intermittently for several years. Exploration has been carried on by means of a long adit level that has been run eastward into a prominent diabase ridge on claim H. R. 397. The contact with the quartzite is drift-covered a short distance west of the portal of the adit, consequently the attitude of the contact is not known. The following description of underground work is taken from the Mining Inspector's report for 1916:

> A tunnel runs northeast into a hill and 700 feet of cross-cutting and drifting has been done at this level. From the east end of the tunnel a raise 158 feet long at an angle of 45 degrees has been driven to the surface. A winze has also been sunk near the face of the tunnel. It is 145 feet deep and is vertical for 90 feet and inclined at 70 degrees for the remainder of the distance. From this winze three levels have been opened up and the following work done: At 50 feet below the tunnel level about 75 feet of drifting and cross-cutting; at 90 feet below tunnel level 400 feet of drifting and cross-cutting and 30 feet of raising; at 145 feet below tunnel level 85 feet of drifting.
>
> The machinery on the claim consists of a Leonard boiler, 80-h.p.; a Laidlaw-Dunn-Gordon compressor, 14 by 14 by 12 inches, a Jenckes hoist 6 by 8 inches.

Milner Townships

Bishop.—The Bishop Mining Company operated a group of claims lying northwest of the northwest arm of Gowganda lake. A shaft on claim T. C. 136 was sunk 130 feet with drifting of 20 feet. The surface of the diabase exposed here is near the top of the sill. A small remnant of the overlying sediment, partly altered to adinole, occurs along the road north of the shaft. The diabase is well fractured and some silver occurs in veins at the surface, but underground operations were discontinued before sufficient lateral work was done to determine the possibilities of the veins underground. The veins have an approximate N.E.-S.W. strike and are nearly vertical. Some of the vein material on the dump shows bloom and flakes of native silver.

Crews-McFarlan.—The Crews-McFarlan mine was not in operation during 1920. It includes four claims, H. F. 221-224, situated near the south end of the southwest bay of Gowganda lake. The property has been worked intermittently since the fall of 1908, following the spectacu-



Specimen of polished ore from the Crews-McFarlan (Bartlett) mine showing calcite vein, one inch in width, with adhering diabase wall. Native silver is shown in the light parts in the form of veinlets and patches in the calcite and along the contact. A little argentite and copper pyrite occur with the silver.

lar discoveries of native silver by two prospectors, F. McIntosh and S. McLaughlin. Under the name of the Bartlett mine, it was first operated by the Bartlett Mines Company, later by the Scottish Nigeria Mining Company, and finally by the Crews-McFarlan Mining Company.

The property is equipped with a plant consisting of two 80-h.p. return tubular boilers, a 12-drill compressor, two hoists and a machine shop.

Shafts Nos. 1 and 2 were sunk by the original company and later operators have increased the underground workings.

No. 1 shaft, at which the most extensive work has been done, is on claim H. F. 222. It is in the lower part of the diabase sill about 500 feet west of the outcrop of the underlying quartzite which dips about 45 degs. westward. The shaft is 300 feet deep with workings on three levels, totalling over 1,000 feet. It was started on a high-grade ore-shoot that extended downward only 25 feet. The ore was massive smaltite and native silver in calcite from two to three inches in width. A series of open cuts were made southwestward from the shaft on a number of lenses of ore over a distance of 350 feet. The chief gangue material with the ore is

calcite, but lenses of the mineral occur with an aplite dike along which the open cut was made. The aplite and diabase wall rock are much fractured in places, and contain sheets and scales of native silver. Some of the vein material carries considerable copper pyrites.

The high-grade ore consisted of smaltite with native silver and argentite. Some of the diabase and aplite carrying abundant leaf silver is of good milling grade. Most of the ore shipped from the property came from the open cut.

No. 2 shaft, located in the southwest part of the property, was sunk 100 feet and drifting and cross-cutting amounting to 360 feet done. The work did not indicate commercial ore. A narrow vein, about one-quarter of an inch in width, carrying massive smaltite and silver, was encountered in the workings.

Directly west of the shaft there is an aplite dike which showed a lens of calcite with smaltite and silver over a few feet. A shallow open cut was made along the lens of ore by the early operators and a few bags of high-grade material obtained.

The most recent work was done on claim H. F. 224 in the southeast part of the property where several veins were located by trenching. One of these, having a width of one inch, contained a shoot of high-grade ore along which an open cut was made and a quantity of high-grade ore obtained. A shaft, No. 3, situated 40 feet to the north of the open cut and near a second vein, was sunk to a depth of 75 feet and at 50 feet a cross-cut made southwestward to the silver-bearing vein on which some exploratory work was done and also on the vein located near the shaft.

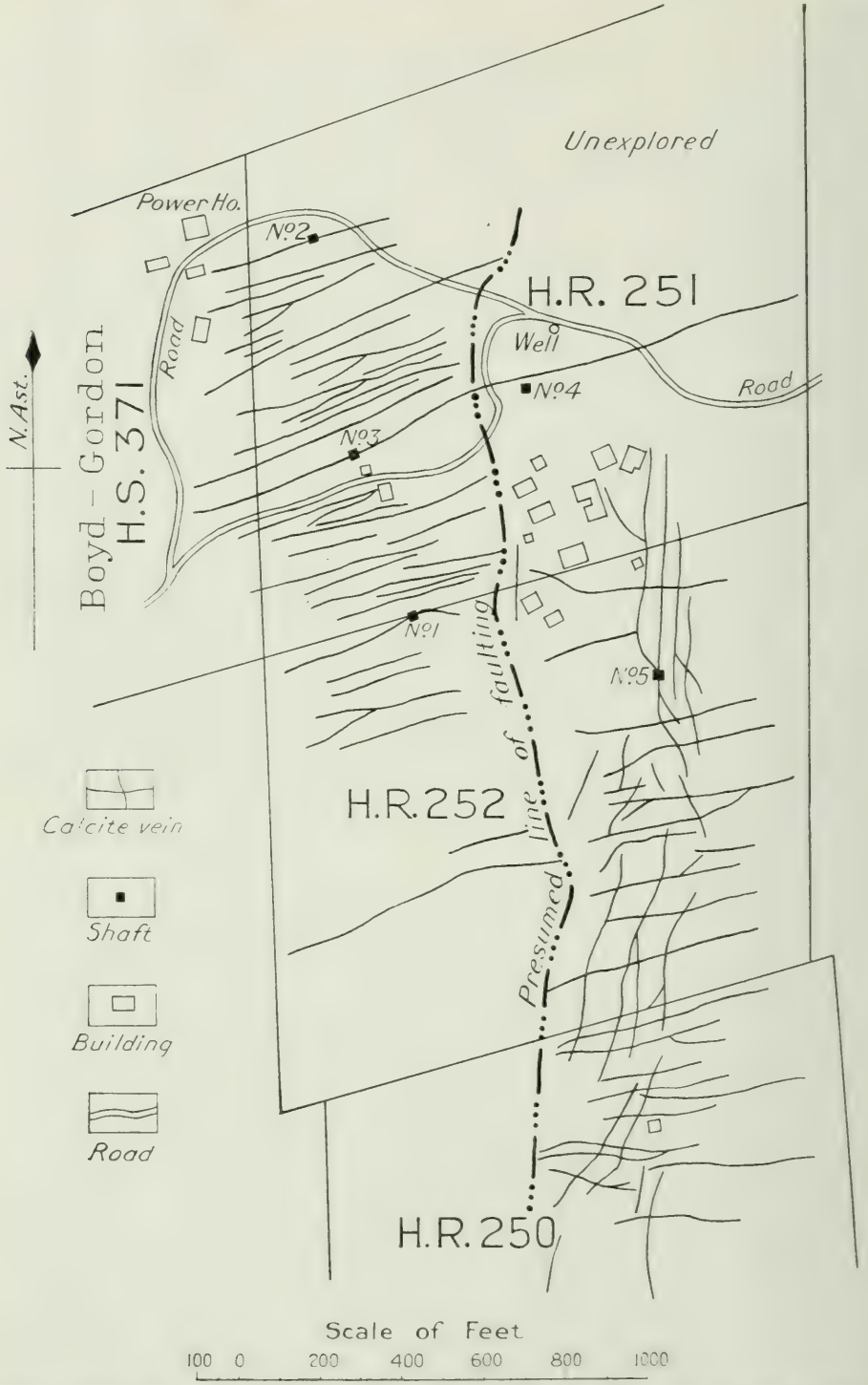
Some silver ore was encountered on this level, but the outlook was not sufficiently encouraging to continue operations under the high cost of operation.

The ore obtained from the open cut was of peculiar appearance in so far that most of the calcite vein matter is very dark, almost black in colour. This dark colour is evidently due to very fine particles of magnetite disseminated in the calcite. Some of the high-grade vein shows massive native silver with argentite in calcite, the silver occurring in veinlets and masses generally near the contact with the diabase. Other samples show massive smaltite with the silver minerals.

Four chains southeast of the shaft there is a 2-inch aplite dike, showing calcite with niccolite and smaltite, on which a shallow pit was sunk.

Hewitt.—For some years previous to 1920, the Hewitt Lake Mining Company operated a group of claims lying west of Gowganda lake and one-half a mile north of the Mann mines. When visited in 1920 no work was being done, and the workings were filled with water. One shaft is reported to have been sunk to a depth of 300 feet with some lateral work, but no information is obtainable as to the silver bearing character of the veins. The Nipissing diabase is exposed at the surface, erosion having removed the overlying sediments from a part of it. Some small patches of sediment still show on the diabase sill, consequently the workings are in the upper part of the diabase where fractures would be looked for.

Mann.—The Mann mine is situated on a diabase ridge one-half mile west of the northwest arm of Gowganda lake. It includes a group of claims: H. R. 249-252, inclusive, staked by the Mann-Ryan interests in 1908, following a discovery of native silver by Robt. Mann. This discov-



Plan showing vein system at Mann Mines, reproduced from sketch furnished by Geo. R. Rogers. The vein in which most work has been done, and from which most of the ore was produced, is No. 3.

ery of silver was made on a bluff of diabase, where a decomposed calcite smaltite vein, about 3 inches wide, showed a rib of native silver protruding from the vein. The vein, known as the discovery or No. 1 vein, was traced several hundred feet by trenching to the west, with several showings of native silver along the surface.

The principal vein is No. 3, which has produced almost all the ore shipped from the mine. The vein has been traced 1,300 feet by trenching, while open-cuts and underground operations indicated several ore-shoots. No. 3 shaft has been sunk to a depth of 200 feet with levels at 80 feet, 120 feet, and 200 feet, while No. 4 shaft, located 350 feet to the east, was sunk to the 80-foot level and connected on this level with No. 3 shaft. Most of the underground work was done on the 80-foot level, where three stopes were opened up to the west of No. 3 shaft and one stope 100 feet west of No. 4 shaft. The easterly stope connects with an open-cut which was made just west of No. 4 shaft. This cut is 30 feet long, and about 14 tons of high-grade ore were taken from it. The ore-shoot pitches westerly at 45 degs., and did not extend below the level. An ore-shoot near No. 3 shaft also shows a pitch to the west, while on the 80-foot level it was 50 feet in length. The ore-shoot was stoped from about 15 feet below the level to near the surface. A third stope was made on the vein 130 feet west of No. 3 shaft, and was also carried from 15 feet below the level to near the surface. The shoot was about 60 feet long on the level. A fourth small shoot about 15 feet in length was found near the end of the west drift on the 80-foot level. High-grade ore was also encountered on the 120-foot level, 200 feet west of No. 3 shaft; 450 feet of drifting along the vein was also done on the 200-foot level of No. 3 shaft.

The vein is about one inch to 5½ inches in width. The ore was hand-sorted at the surface and bagged for shipment. Twenty tons of low-grade ore were treated at the Millerett mill in 1912, and from this 715 ounces of fine silver were produced.

The high-grade ore is chiefly native silver with smaltite in calcite. Forty-eight tons of high-grade silver ore, from which were recovered 99,076 oz. silver, were shipped from the property.

One shipment averaging 2,000 ounces per ton silver contained $2.00 per ton in gold.

On the Mann property there are two pronounced north and south ridges. On the westerly ridge all of the veins have a strike of a few degrees north of east, whereas on the easterly ridge there are a number of veins which strike nearly north and south, in addition to a number which strike easterly and westerly. This has suggested the possibility of faulting. The underground work proved a strong north-south fault dipping 45 degs. W., with a crushed zone about four feet in width. The westerly part of No. 3 vein was displaced 15 feet to the south by this fault.

The Boyd-Gordon mine, H. S. 371, was taken over by the Mann mine in 1912.

George Rogers was in charge of the Mann property during most of the development of No. 3 vein from which the shipments were made.

The property was closed down in 1914.

Northcliff—The Northcliff prospect is situated at the north end of the northwest arm of Gowganda lake. The property consists of about 160 acres, the principal claim of which is J. S. 282. The veins are in the Nipissing diabase, which occurs as a high ridge along the northeasterly shore of the lake. The ridge rises abruptly from the water's edge to an

elevation of 125 feet. The relationship to the conglomerate is seen along the north line of J. S. 282, where the diabase underlies the conglomerate at 60 degs. W.

The property was operated from the fall of 1919 for about one year. Some surface work was done on a series of veins on the top of the ridge. An open cut 25 feet long was made on a calcite vein with strike N. 20 degs. E., which averages from about an inch to three inches in width. Some specimens showing crystallized smaltite and silver were taken from the open cut. The vein is faulted at the south end of the cut, ten feet westward. Shallow cuts and trenches were also made on some other fractures near the open cut. Most attention was, however, given to driving a tunnel eastward into the hill from near the water's edge. This work was stopped before it was certain that the underground extension of the surface vein carrying silver had been intersected. Several calcite veins, from an inch to three inches in width, and a stringer of quartz showing some silver, were cut in the tunnel, but no drifting was done on them.

The tunnel is about 285 feet in length. The work was accomplished by using steam drills, but this was not found satisfactory, and it is expected when conditions improve that a compressor plant will be installed. Norman Dye is manager of the property.

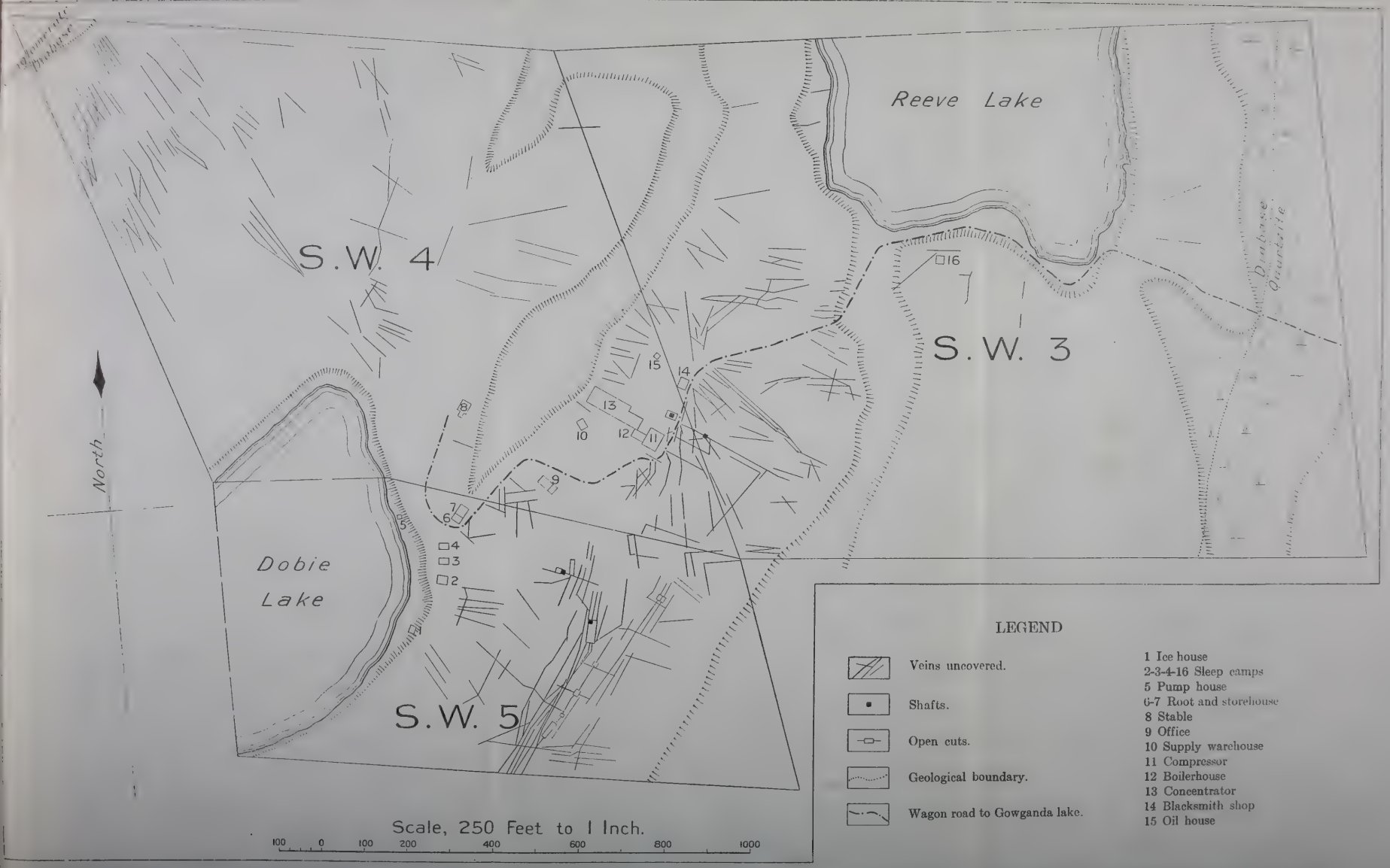
Reeve-Dobie.—The Reeve-Dobie mine, which has been operated intermittently since 1908, was closed down in the fall of 1920. It has been worked by various interests. The original discoveries were among the most spectacular in the camp, and from open-cuts along short ore-shoots some very rich silver ore was shipped. The early work consisted in prospecting for high-grade ore which was found to occur in a number of short shoots along a mineralized zone about 700 feet in length. Most of the high-grade ore was taken from a number of open-cuts. Later a mill was erected which ran for a short time treating diabase carrying minute veinlets containing native silver. The mill was reopened in 1919, a flotation plant added and ore from an open-cut or glory hole to the south of the shaft was treated. The ore was dropped to the 50-foot level and trammed to the shaft. The mill rock was said to carry from 30 to 35 ounces of silver per ton. Underground operations were carried to the 200-foot level and considerable drifting and crosscutting was done. A number of strong faults were encountered in the workings.

Very little work has been done on the westerly side of the property where there is much fracturing.

South Bay.—The South Bay Mining Company did exploratory work several years ago on claims H. S. 723 and H. S. 724. They also sank a shaft to a depth of 100 feet on the O'Brien claim H. S. 602, lying to the west. There is a series of five calcite-quartz veins near the shaft, with a general strike of NW.-SE., running from H.S. 602 to H.S. 723. In addition to the shaft, several large open-cuts were made on veins. A description of the property is given in a report on the Gowganda Silver Area: (1)

Active development was in progress at that part of the property which adjoins the southeast claim of the Bartlett mine when visited in October, 1912. A great amount of surface trenching had been accomplished, and open cuts had been made on some of the veins. Smaltite, niccolite and silver were found at different points. At one place 90 feet south of the shaft some high-grade ore has been taken from a cut about 20 feet in length. The shaft was down 100 feet, and a cross-cut was being run to the south to intersect three N.W. and S.E. veins which showed on the surface. A north cross-cut

(1) The Cobalt-Nickel Arsenides and Silver Deposits of Temiskaming, Ont. Bur. Mines, Vol. XIX, 1913, PART II, p. 186.



Plan showing vein system at Reeve-Dobie mine, reproduced from mine plan furnished by the company. The principal workings are on the NE-SW veins in the southeasterly part of the property.

was also being run towards a vein with strike N. 60 degs. W. which crosses from the Bartlett property. A 50-foot shaft had also been sunk just south of the north boundary line, on a vein parallel to the one just mentioned. The material on the dump consists of diabase, with aplite and calcite. Native silver and argentite occur in some of the vein material. Part of the vein about one inch in width consists of crystallized epidote and quartz carrying silver and argentite.

Columnar structure is quite pronounced in the diabase, and along the joints veins have been formed, suggesting the filling of cooling cracks. Some of the country rock is quite reddish and coarse-grained, and traceable into the dark grey diabase. Much of the reddish rock adjoining the veins is greatly stained with cobalt and nickel bloom.

Van Hise Township

Alpine (*Gamey-Thompson*). —The property of the Alpine Silver Mines is situated in the west part of Van Hise township to the northwest of Spawning lake. Here there is a north-south ridge of diabase about 2½ miles in length, reaching an elevation of 200 feet above the surrounding plain which consists of sediments of the Cobalt series overlain in part by sand and gravel.

A series of aplitic veins was discovered on the diabase ridge, along which a great amount of trenching accompanied by the sinking of shallow pits and two shafts to moderate depts, has been done. Associated with the aplite dikes are lenses and veinlets of calcite which occur in different parts of the dikes, as shown along the surface. Most of the work has been done on claim H. R. 458. The aplite dikes vary from about 6 inches to one foot in width.

A northerly trench is along an aplite dike for 140 feet, showing veinlets of calcite, and aplite impregnated with calcite, with frequent occurrences of native silver. Along one streak the calcite is two inches in width on the north wall of the dike, which strikes N. 83 degs. W.

A second aplite dike has been followed for 450 feet by means of trenches. It has a strike of N. 20 degs. E. for 120 feet at the northerly end, and a strike of N. 60 degs. E. for the southerly portion, while the dip is 80 degs. W. The best surface showings occur north of the 30-foot shaft. Some rich nuggety silver ore was taken from an open-cut just north of this shaft. The matrix is also aplite, with lenticular calcite structures. A third dike occurs at the southwest end of the second dike, and has been followed for 300 feet. Just south of the intersection of the dikes there is some high-grade ore.

A tunnel 575 feet in length has been driven from the base of the hill westward to intersect the first dike at a depth of about 170 feet. The aplite dike was drifted on underground for 80 feet before work was discontinued.

A shaft was sunk on another aplite dike with NW-SE strike to a depth of 29 feet.

The diabase sill has been fractured with the formation of intersecting aplite dikes, along which segregations of calcite carrying native silver have been formed at several points on the dikes.

The columnar jointing planes exposed in the long tunnel would suggest that the diabase is in the form of a sill rising from the east.

A power plant consisting of a 60-h.p. boiler and 3-drill compressor was installed recently and exploration will be carried on in 1921.

E. J. Thompson is superintendent.

Hedlund.—During 1920, L. O. Hedlund was prospecting T. C. 141 and an adjacent claim to the east, situated a mile and a half north of the northwest arm of Gowganda lake. These claims are around what was formerly known as McLaughlin lake, but which has been drained by the blasting of a rock ledge at its lower end in aid of the waterpower supply of Gowganda lake, the lake now being represented by a marsh. Considerable work was done on the west side of the marsh in the sill diabase, and also on the easterly side, in a dike of diabase which intrudes the conglomerate. The best results were obtained west of the marsh, where there are quartz veins showing some native silver. A shaft has been sunk to a depth of ten feet at the junction of a quartz vein two to three inches in width with strike NE.-SW., and narrow transverse stringers of aplite. The quartz vein with offsets has been traced southwesterly several hundred feet. It has a banded structure showing scales of native silver in the white quartz, together with copper pyrites, galena and a little niccolite at the shaft. A little cobalt bloom was also seen in the narrow veins near the shaft. The transverse veins at the shaft also show a little native silver in the aplite.

The sill diabase outcrops at a few places in the marsh, but was not observed in contact with the older rocks that occur to the east of the marsh. On the west side of claim, T. C. 141, the diabase underlies the conglomerate at a high angle.

Charters Townships

Garvey.—The Garvey claim, E. D. 123½, situated west of the Montreal river, in the south part of Charters township, was being prospected during the summer of 1920 by the Garvey Bros. A number of veins were discovered on a knoll of diabase near the west line of the property.

The veins vary greatly in strike, and are more or less connected as revealed by the trenching. The vein in which most silver was noted is about an inch to two inches in width, strikes N 60 degs. E and was traced for 125 feet. In part of the distance there is an open fissure, but toward the easterly end of the trench, for a distance of 30 feet, there are showings of high-grade ore, consisting of silver and smaltite, some of the silver being in the black decomposition products of cobalt and nickel minerals. A second vein, 13 feet northwest, strikes N 48 degs. E and contains aplite six inches wide together with calcite. Fragments of the aplite show scales of native silver. Cobalt bloom can be seen along the walls of several other veins, represented by open fissures for six inches or more. The discoveries having been so recently made, practically no work has been done beyond trenching, so that more time will be required to prove their economic value. The greatly fractured diabase knoll affords a promising location for considerable exploratory work.

Haines.—The Haines claim, H. R. 439, is in Charters township, one-half a mile south of the Garvey claim and near the south boundary of the township. Some work was being done in a shaft on a vein which strikes N 45 degs. E. The shaft was down 11 feet, and for six feet from the surface showed a lens of calcite carrying some silver and smaltite, while at the bottom of the shaft there is a thin seam of calcite.

Work was also done by the same interests on claim G. G. 2606 in Donovan township, where a shallow shaft has been sunk on a calcite vein from an inch to two and a half inches in width with a strike N 62 degs. E. The vein carries disseminated smaltite, niccolite, chloanthite and some

native silver. The rock is a coarse-grained diabase showing some reddish granophyric interstices of quartz and feldspar.

Leith Township

Hudson Bay.—This property is in the southeast part of Leith township, and includes mining claims H. S. 695, 696, and 716. It was operated from 1910 to 1913, but has since been idle. Two shafts were sunk on silver-bearing veins on claim H. S. 716 and one shaft on claim H. S. 696. When visited in 1920 some of the veins could be seen at the shafts near the surface, while some heavy smaltite silver-bearing ore was picked up on the dump. It is reported that about six tons of silver ore were taken from the workings, chiefly from shaft No. 2.

At No. 1 shaft, which was sunk 94 feet with a drift of 128 feet, there is a strong calcite vein 7 inches in width in addition to some narrow stringers. Some massive smaltite, 20 inches in width, is reported from the open-cut.

No. 2 shaft was sunk 110 feet with drifting of 274 feet. The vein showed near the collar of the shaft a width of two inches with a dip of 80 degs. NW.

No. 3 shaft was sunk 214 feet with drifting amounting to 362 feet on the 76-foot level, and 359 feet of drifting and cross-cutting on the second level. The vein in shaft No. 3 is reported to be from one inch to four inches wide, and in places to carry high values in silver. Four veins were met with in drifting, two of them showing native silver.

It is expected that this property will be reopened when conditions of mining and transportation are improved.

Silverado.—The Silverado Mining Company is operating a group of 14 claims located in the southeast part of Leith township and the southwest part of Charters township, most of the claims being in Leith. The property is adjacent to the Hudson Bay mine. Most of the exploratory work has been done on claim H. S. 693, where several veins have been located. Nos. 1, 2 and 3 veins have a general N-S strike. Some trenching and shallow pits have been made on these veins, indicating the occurrence of smaltite, niccolite, copper pyrites, aplite and calcite. Native silver was found in No. 1 vein, and also in No. 4 vein, which strikes more nearly east and west. Some very high-grade silver ore an inch in width was obtained from a pit on No. 4 vein.

A shaft has been sunk on No. 3 vein to a depth of 100 feet, and a drift to the north and a cross-cut to the southwest were begun to intersect veins that outcrop at the surface.

The veins are in the Nipissing diabase, with which conglomerate and quartzite of the Cobalt series form the contact. On claim G. G. 4149 the sedimentary rock adjacent to the diabase has been altered to adinole, showing rounded spots. The top of the sill is exposed in the locality.

The plant consists of an 125-h.p. return tubular boiler, a 7-drill compressor, hoist and pumps. A saw-mill has also been erected to prepare lumber for the mine buildings.

Donovan Township

Duggan.—Some work was done on claims H. R. 720, and T. C. 418 during part of 1920 by Howard Duggan. These claims are along the east branch of the Montreal river in Donovan township. Veins were discovered by earlier stakers in 1909, and in succeeding years considerable

prospecting was carried on by means of trenches and open-cuts. On claim H. R. 720 there is a calcite vein three inches in width with strike N. 71 degs. W., that has been traced for about 400 feet on the claim and on adjacent claim to the northwest for 200 feet. A little native silver, smaltite and niccolite were found in places in the calcite. A pit 10 feet deep was sunk on the vein 150 feet east of No. 4 post. Just west of the pit is another vein, three inches in width, showing calcite with a little smaltite, crossing the longer vein.

Two veins of calcite carrying bloom and copper pyrites occur in the northwest part of claim T. C. 418.

Wilder.—Claims G. G. 3541 and 3542 , located in Donovan township, a quarter of a mile east of Collins lake, were explored by Frank Wilder during part of 1920. An open-cut 28 feet long and nearly five feet deep was made along a calcite vein varying in width from half an inch to two inches, and in strike from N. 65 degs. E. to N. 45 degs. E. A few segregations of native silver and smaltite together with some niccolite in one place occur in the calcite vein. Two branch veins, one two inches wide and the other from one inch and a half to four inches wide, are shown near the southwest end of the open-cut. Two of the showings of silver are near the intersections with the main vein. Seven feet north of the east end of the cut on the main vein a second vein, varying in width up to two inches, has been followed northeasterly for 175 feet. The wall rock of the veins is Nipissing diabase.

Morel Township

Bishop.—During part of 1920 Wm. Shields carried on exploratory work on claim L. O. 305 lying to the northwest of Bloom lake. A vein with east-west strike and varying in width up to six inches, was trenched for several hundred feet. The vein filling is calcite which carries in places smaltite, together with some massive bornite and native silver. The wall rock is Nipissing diabase. The shaft was sunk to a depth of 50 feet.

Corkill Township

The township of Corkill came into prominence after the discovery of native silver on the Kell claims, G. G. 3786, 3449, about 12 miles southeastward from Gowganda. The locality is reached by a wagon road which leaves the main Elk Lake-Gowganda road about one-half a mile west of Long Point lake. From Gowganda a canoe route up the east branch of the Montreal river to the lower end of the third portage can be used. From here there is a trail eastward by way of Steele lake and partly following the south boundary of Charters township to Corkill township.

Corkill is largely covered with sand and gravel deposits of glacial origin, occurring in plains and gently rolling ridges. The township contains a number of spring lakes, the largest of which is Lady Isabel, locally called Beauty lake. This lake has beautifully clear water, has no surface outlet, and abounds in lake trout. Brook trout are found in several spring creeks in the area south of Long Point lake.

Geology

Several ridges of Nipissing diabase and Animikie quartzite outcrop through the drift. Of these the ridges of diabase form the chief topographical features, reaching in places 250 feet above the plain.

Diabase.—The diabase ridge in the southwest corner of the township was examined closely. Its structure is that of a highly inclined sill rather than a dike. The normal quartz diabase is dark grey, but in a few places was found to contain dark red spots which are chiefly acid plagioclase (albite) showing some differentiation not recognized in dikes. Microscopically, the rock has an ophitic texture, the laths of feldspar being partly altered to saussurite, and the augite partly to chlorite. Micrographic intergrowths of quartz and red plagioclase occur abundantly in the interstices of the specimen examined. The diabase resembles that of Gowganda, Elk lake and elsewhere, and is clearly in the form of a sill. An excellent contact of the overlying diabase and the quartzite occurs on the line between claims G. G. 4247 and 4326. The contact is well up the east side of a steep ridge that overlooks Shack lake and dips westerly at 55 degs.

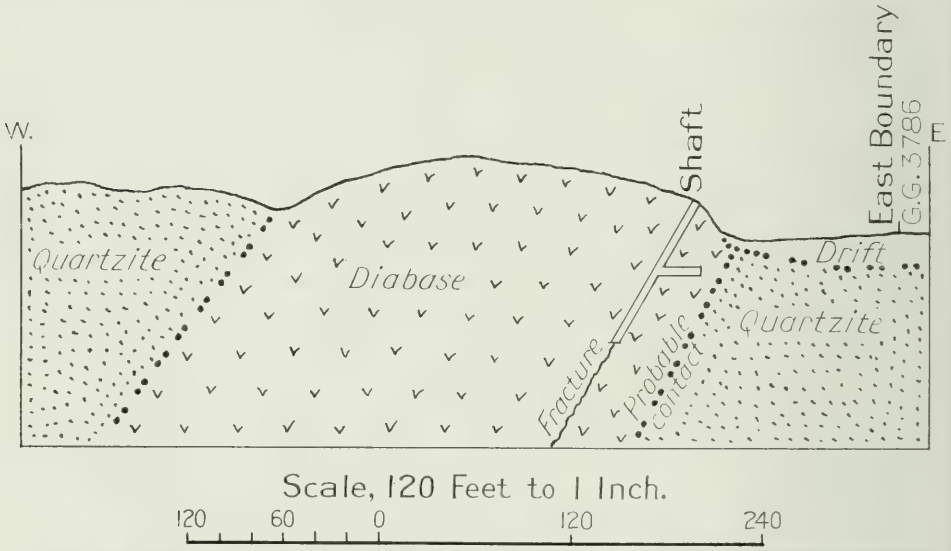
Quartzite.—Quartzite of varied grain and colour is the only sedimentary rock found in the area near the silver discoveries. In this respect this area resembles Cane and Auld townships and the silver area near Maple Mountain.

Discovery of Silver.—Claims were staked as early as 1909, but little work was done until several years later. The discovery made by Hugh Kell and associates was of native silver in veins on a narrow diabase ridge on G. G. 3786 in the southwest part of the township. The first find was made in a number of loose fragments of diabase carrying sections of a calcite vein. Further exploration resulted in the finding of native silver in place at points along the easterly side of the ridge. Here there is a main fracture that roughly parallels the contact with the quartzite, dipping 55 degs. to 60 degs. westward. What appears to be the same fracture zone has been located by means of trenches and pits at intervals over several claims. The main fracture varies up to 18 inches in width. The principal constituents are calcite and quartz, carrying angular fragments of diabase and showing cobalt bloom in places along the surface. There are also roughly parallel veinlets of quartz and calcite, mostly on the footwall side of the main fracture, as well as subsidiary veins that run diagonally from the main fracture. In some of these latter high-grade silver ore was discovered.

Exploration of Kell Claims.—The property was optioned during 1919-20 to J. G. Smith, ex-Governor of Vermont. Well-constructed camp buildings and a steam power-plant were built on claims lying to the east of those carrying the silver-bearing veins. The steam plant consists of an 80-h.p. boiler, a 4-drill Ingersoil-Rand compressor and a 6 by 8-inch Jenckes hoisting engine. An inclined shaft, 58 degs., was sunk on the main fracture to a depth of 104 feet, and 275 feet of drifting on the 54-foot level and about 50 feet on the 100-foot level accomplished. A raise was also made from the 54-foot level to an outcrop of high-grade ore 25 feet south of the shaft. The diabase along the footwall in the shaft showed some native silver to the 100-foot level, and a little silver was encountered in the drift on the 54-foot level to the south of the shaft.

A small shipment of ore, 1,584 lbs., containing 1,620.9 oz. of silver, was made from an open-cut south of the shaft, together with a few bags from an open cut 700 feet north of the shaft. A number of prospecting pits have been sunk along the main fracture. From one of these, 200 feet south of the shaft, good specimens of the rare nickel sulphide, millerite, were obtained. An assemblage of minerals, including argentite, smaltite, niccolite, millerite, together with small quantities of magnetite, specu-

larite and pyrrhotite, have been obtained from the calcite-quartz veins. The presence of the last three minerals indicates a high temperature of formation of the veins. Most of the ore shipped consisted of white calcite with native silver in scales, together with some argentite. Some heavy smaltite with native silver was obtained from an open cut north of the shaft. Work had been discontinued for two months when the property was visited in July, 1920, so that only the surface conditions could be studied. From information obtained and an examination of the surface, it was judged that the narrow subsidiary calcite veins on the footwall side of the main fracture afford the most promise for high-grade silver ore.



Cross section at Kell property, Corkill township, showing highly inclined attitude of diabase sill and shaft on fracture near footwall.

Kell (G. G. 4124 and 4125).—Mining claims G. G. 4124 and 4125, along the west shore of Lady Isabel lake, belong to Hugh Kell. The rock here is diabase, occurring as a N.W. and S. E. ridge outcropping through the drift. Unlike the fracture on the Kell claims previously described, the veins are transverse to the long axis of the diabase outcrop. They are largely of quartz with a ribboned structure. Calcite lenses occur with the quartz veins. Small particles of galena and copper pyrites are frequently seen. A little native silver occurs in the quartz and as scales in the diabase. A series of veins averaging one to three inches in width occur along the easterly base of the diabase ridge running back over the hill. At one place there are three in a width of 15 inches. A few shallow pits have been sunk on several veins, but many of the veins are unprospected.

South Bay Power Company

A hydro-electric power plant has been installed by the South Bay Power Company at the outlet of Hangingstone lake, where it discharges into Gowganda lake. The natural head is 58 feet, but by means of a dam this has been raised to 69 feet, 4 inches. The flume is 450 feet in length, most of the fall being near Gowganda lake. The drainage area of Hangingstone lake is approximately 39 square miles, and the present plant is a 250-horsepower installation.

II. AULD AND CANE TOWNSHIPS

By A. G. Burrows

Location

The townships of Auld and Cane are in the district of Timiskaming about 20 miles northwest of Cobalt. The Montreal river flows diagonally across Auld, so that about half the township is in the Timagami Forest Reserve. Cane lies directly north of Auld, and the Elk Lake Branch of the Temiskaming and Northern Ontario railway traverses the northerly part of the township.

Means of Access

The mineral area is connected by a wagon road, about six miles in length, with Kenabeek station, situated in Henwood township. The southerly part of the area is readily reached from Latchford by gasoline launch to Indian lake, from which there is a mile portage to Lepha lake. From Lepha lake there is a good trail to the Triangle silver mines.

Topography

The prominent feature of the area is the winding diabase ridge that, in places, is 150 feet higher than the plain. The easterly part of Auld and a part of the south portion of Cane are quite rugged and rocky. Most of Cane has been taken up as farm land, the greater part of the township being suitable for agriculture. The country, except where cleared, burned or lumbered over, is well timbered with spruce, jack pine and other soft woods. Large quantities of spruce have been shipped as pulpwood.

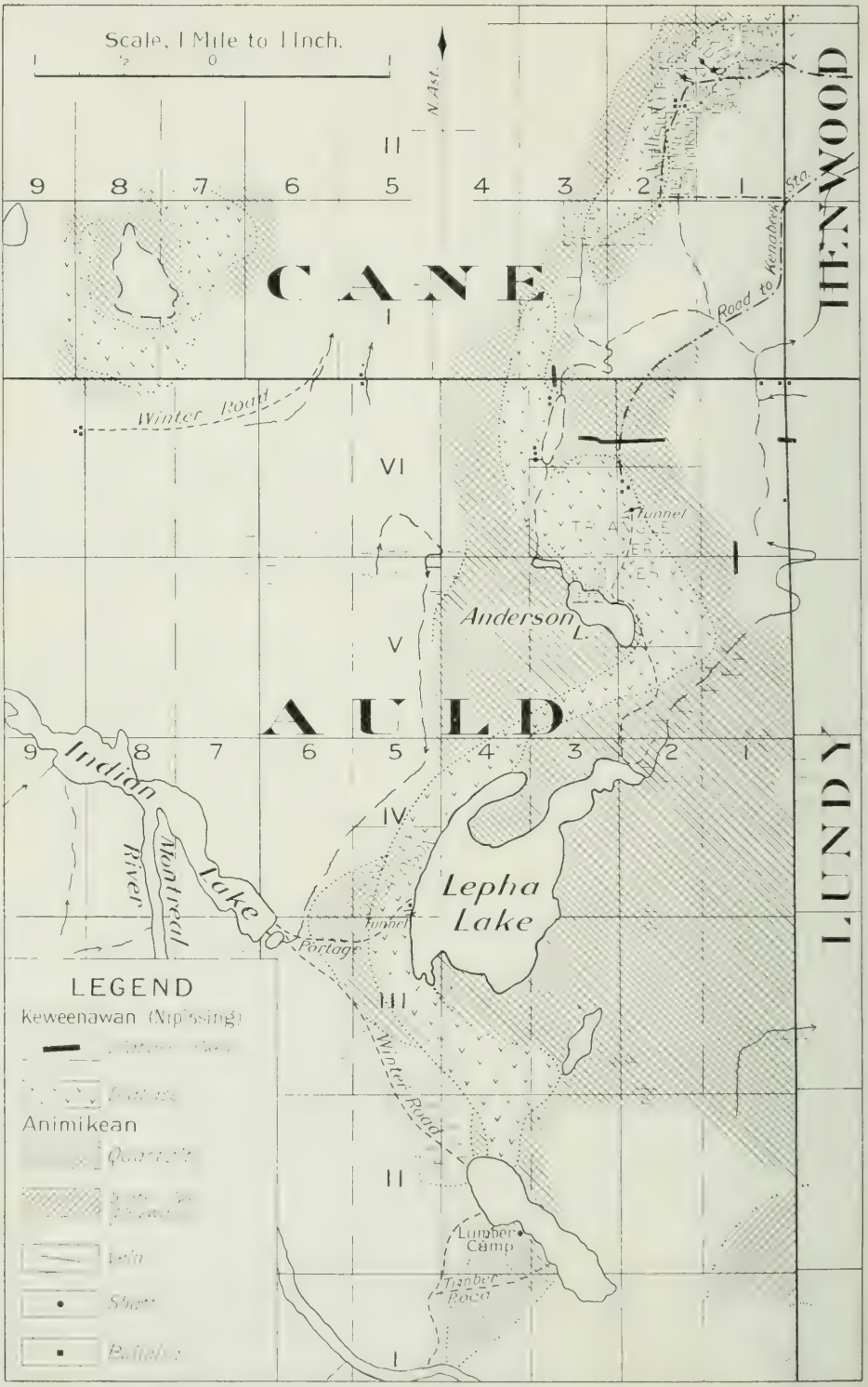
Geology

Two geological series are found in the area, namely, quartzite together with some slate-like greywacké of the Animikie age, and quartz-diabase of Nipissing (Keweenawan) age.

Animikie—The Animikie consists chiefly of quartzite, which is found so abundantly in the Montreal river district. It resembles the quartzite known as the Lorrain quartzite near lake Timiskaming, at Maple mountain and elsewhere. These rocks occur in thick beds usually with low dip. They are of greyish, greenish and reddish colour, and sometimes show some rounded quartz pebbles.

A small quantity of slate-like greywacké occurs in the southeast part of Auld, near the Montreal river.

Nipissing Diabase.—The quartzite is intruded by sill diabase which for the greater part occurs as a long, narrow ridge with a general north and south strike. Several contacts were observed in the field, which indicated that the diabase rises toward the west and dips under the quartzite toward the east. Several contacts were observed on the northeast quarter of the north half of lot 3 in the first concession of Cane, showing the upper contact of the sill, and with dip varying from horizontal to 45



Geological sketch map of parts of the townships of Cane and Auld.

degs. S.E. Other hanging-wall contacts were found to the southeast of the small lake in the north half of lot 3 in the sixth concession of Auld. Footwall contacts, showing the bottom of the sill resting on quartzite, are exposed just southeast of Anderson lake, and a quarter of a mile north of the northwest bay of Lepha lake.

An irregular area of diabase also occurs in the first concession, lot 8, of Cane, the relationship of which to the quartzite was not observed.

The diabase is mostly of the dark-grey variety, but shows in places some red phases. Occasionally some red spots of intergrown acid plagioclase and quartz are conspicuous in the dark-grey normal diabase.

Numerous dikes of red aplite, up to about two feet in width, are found here and there throughout the diabase. These dikes are frequently associated with the cobalt, nickel and silver ores. A few unimportant diabase dikes intrude the quartzite.

Veins

There are a number of veins of calcite and dikes of aplite that are silver-bearing. They occur toward the hanging-wall side, or upper part, of the diabase sill. The main outcrop of diabase is a long narrow section of a sill extending in a general north and south direction. The veins of calcite and dikes of aplite are approximately at right angles to the contact of the sill with the overlying quartzite, consequently the strike approaches east and west. A number of properties have been located on the diabase ridge, and the exploration of those along the easterly side has shown silver-bearing veins of promise.

Generally where an aplite dike is mineralized, it is accompanied by calcite and quartz veinlets, either irregularly in the dike or parallel to it. Veins in which aplite, quartz and calcite occur are more numerous than the ordinary silver-bearing calcite veins. The silver-bearing aplite dikes vary in width from an inch to 18 inches. The aplite is a differentiation from the diabase magma, sometimes occurring in dikes with well-defined walls. Again, the aplite may grade into the normal dark diabase and still have a dike-like structure, suggesting a segregation from the diabase magma in the process of cooling with consequent shrinkage, the more acid portion of the aplite being near the centre of the dike.

The quartz in the veins is later than the aplite, and the calcite the latest gangue mineral. Frequently there is a narrow band of quartz between the diabase, or aplite, and the calcite.

The smaltite usually accompanies the calcite, and native silver may occur as masses in the smaltite and calcite, or as sheets and scales in the quartz, aplite and diabase. Where veins of calcite occur in diabase or aplite, one portion may be replaced over its width with massive smaltite and silver, and thus show bunches or small shoots of high-grade along the vein, with adjacent parts containing little or no smaltite or silver.

Properties

Cane.—The Cane Silver Mines comprise three mining claims, M. R. 5277, 5251, 5276, in lot 2 in the second concession of Cane township. They are situated along the narrow ridge of diabase that extends from Auld to Cane.

A number of silver-bearing veins occur along the easterly side of the diabase ridge in proximity to the overlying quartzite, consequently they

are in the upper part of the diabase sill. They are approximately at right angles to the contact, varying in strike from N. 70 degs. E. to S. 70 degs. E. Eight veins have been located and work was being done on three of them in the fall of 1920. Open cuts were made on veins Nos. 1, 2 and 8, and ore has been bagged from each of these. No. 1 was traced for 175 feet, with strike N. 70 degs. E. and dip 80 degs. N., extending westward across the boundary to the next claim. This vein is aplitic in character, showing lenses of calcite, smaltite, niccolite and silver and some bismuth, varying in width up to four inches. There are also branching veins, in one place three in a width of four feet. There is also some leaf silver in the diabase along the veins. One lens of high-grade ore that was mined was about three feet long, carrying massive smaltite studded with native silver. A sample of high-grade ore has the following partial composition: Co.—19.29; Ni.—3.67; As.—46.44 per cent.

An open-cut was made on No. 2 vein which contains two leads about two feet apart. Aplite is also the chief gangue of these veins, one showing a width of two to three inches, with streaks of high-grade silver ore about ¼-inch to ½-inch thick, and forming a rib-like structure in the aplite. At times the high-grade ore runs diagonally across aplite. These high-grade streaks carry silver, smaltite and calcite. Some leaf silver is also found in the diabase near the veins.

No. 8 vein, on the northerly claim of the group, is also of aplitic dike character with an average width, where exposed by trenching, of 14 inches. One section of the dike for 20 feet shows an abundance of cobalt bloom on the surface. An open cut was made along this section, revealing lenses and impregnations of smaltite carrying native silver. The silver-bearing smaltite occurs irregularly, sometimes along the walls of the dike, sometimes running diagonally across the dike, and again as rounded nodular-like masses in the aplite. The aplite where it contains smaltite and silver is impregnated with calcite. A shaft was sunk on this vein, using hand steel, to a depth of 40 feet, the vein maintaining its width with ore similar to that found at the surface. Work was stopped in December. It is expected that a compressor plant will be installed at a later date, when mining will be resumed.

Previous to October 1, 1920, 100 sacks of ore weighing 3½ tons and assaying 402 ounces of silver per ton, were shipped from open-cuts to the Cobalt Reduction Company. One hundred sacks in addition were taken from the open-cuts and shaft before work ceased for the winter.

J. J. Byrne is manager of the property.

Triangle.—The Triangle Silver Mines, situated in Auld township, consists of 1,000 acres, being part of lots 2 and 3 in the fifth and sixth concessions. Silver was discovered on the group in 1912, and this discovery is described by C. W. Knight (1) as follows:

"On the Hitchcock location, south half of lot 3, Con. VI, there are a number of narrow east and west veins, in some of which native silver with some smaltite and bloom have been found. The wall rock of the veins is usually aplitic. On the westerly side of the easterly diabase ridge native silver occurs in fairly coarse dentritic form. At the northerly exposure there is coarse-grained reddish aplite which is heavily stained with bloom. The aplite has more the character of a differentiation of the diabase than a clearly defined dike. At the other exposure where silver was seen, there is a grey aplite along one perpendicular surface of which there is native silver in dendritic form.

(1) Ont. Bur. Mines, Vol. XIX, 1913, Part 2, p. 163.

Veins were later discovered on lot 2 lying to the east and near the contact with the quartzite. The group of claims was operated first as the Kenabeek Silver Mines and later re-organized as the Triangle Silver Mines. On lot 2 a tunnel has been driven westward on a fracture on the east side of a high diabase ridge. The principal work, however, has been on a series of veins, the principal one of which strikes N. 66 degs. E. and dips 80 degs. S. A shaft has been sunk to the 132-foot level, on the dip of the vein, and to the 182-foot level at a flatter angle. Drifting and cross-cutting have been done on the two levels, most of the work being on the upper level. A faulted zone, 10 feet to 12 feet in width and dipping flatly southward, was encountered at the first level.

The calcite veins on which underground work was done carry segregations of native silver, smaltite and niccolite. The veins vary from an inch to six inches in width, while some heavy sheet silver is occasionally encountered in the wall rock. A small quantity of ore has been raised from the mine but no shipments have been made.

W. R. Hitchcock is managing director and W. H. Jeffrey is mine manager.

Shepp.—The two principal claims of the group are M. R. 5279 and M. R. 5286, lying just northeast of the Cane Silver Mines. An aplite dike 8 inches wide and dipping 80 degs. N.E. crosses the line between the two claims; two shafts have been sunk to moderate depts and some trenching done. The southerly shaft was sunk at the junction of two aplite dikes 6 inches and 8 inches in width. The material on the dump shows some massive smaltite, partly altered to cobalt bloom, together with a little native silver. The exposure here somewhat resembles that at No. 8 vein at the Cane mine. The property had not been worked recently, and the shafts were filled with water.

Bradley-Donaldson.—The Bradley-Donaldson property includes the south half of lot 5, con. IV., Auld. It is situated on the west side of Lepha lake, along the westerly shore of which is a high diabase ridge sloping steeply to the lake. No work has been done in several years, and the camp buildings are dismantled. A tunnel was run westward into the ridge on a calcite vein near the south boundary of the property, and it is stated that some native silver was obtained from the workings now filled with water. Fragments from the dump show a banded structure in the vein, which is composed chiefly of grey calcite with narrow ribbons of quartz. The structure indicates a replacement type of vein along a fracture in the diabase. In this localtiy the diabase dips steeply beneath the quartzite and the workings are near the upper contact.

End of Part III.

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Province of Ontario, Department of Mines

Hon. H. Mills, Minister of Mines — Thos. W. Gibson, Deputy Minister

THIRTIETH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

VOL. XXX, PART IV, 1921

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PRINTED BY ORDER OF THE LEGISLATIVE ASSEMBLY OF ONTARIO

TORONTO
Printed and Published by Clarkson W. James, Printer to the King's Most Excellent Majesty
1922

Printed by
THE RYERSON PRESS

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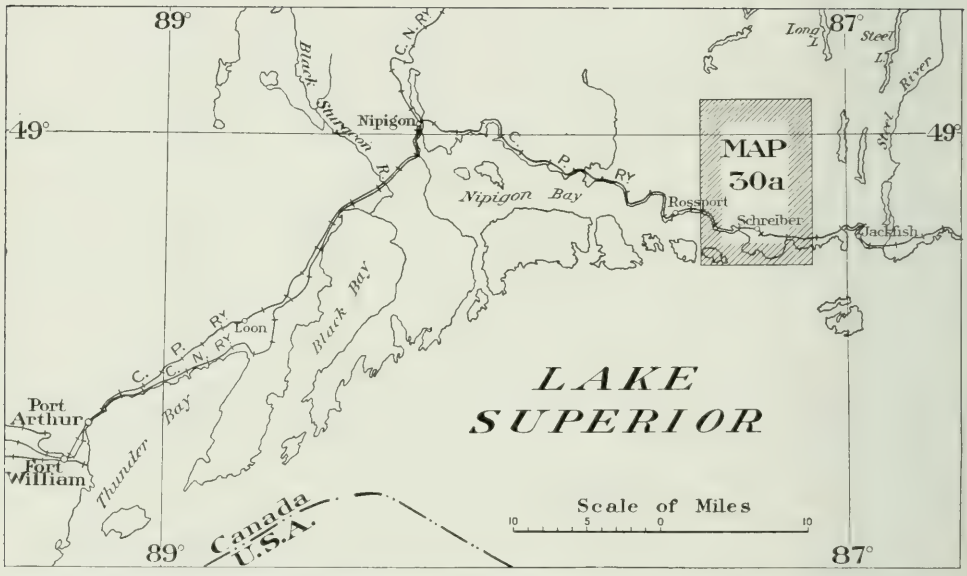
GEOLOGICALLY COLOURED MAP

No. 30a,—Schreiber-Duck Lake Area, scale 2 miles to the inch.
(*In pocket on inside of back cover.*)



Index Map showing location of area covered by the Schreiber-Duck Lake map, No. 30a.

SCHREIBER—DUCK LAKE AREA

By Percy E. Hopkins

Introduction

This report deals with the geology and economic resources of an area lying on the north central shore of Lake Superior between the Whitesand and Black rivers and northerly to Big Duck lake, embracing approximately 210 square miles. Schreiber, a divisional point on the Canadian Pacific Railway, is situated in the south central part at 48°50′ north latitude and 87°50′ west longitude, 133 miles east of Port Arthur.

Accompanying this report is a coloured geological map of the area on a scale of one mile to the inch. The water routes shown in full lines on the map were surveyed by micrometer and prismatic compass and tied to surveyed mining claims or to the railway. Townships referred to by numbers 84, 85 and 86 have been outlined on the map, but as yet are not completely surveyed. The rugged nature of the country, the difficult canoe routes, and the absence of roads tended to make the mapping difficult. The geology and topography of the area between Lynx and Birch lakes, Copper island and Rope lake were kindly furnished in advance of publication by T. L. Tanton of the Geological Survey of Canada.

A. R. Clark and C. S. Parsons acted as assistants during the season, and rendered efficient service. The accompanying sketches were drawn by P. A. Jackson and H. C. Smith. The writer wishes to express his thanks to W. L. Longworth, L. H. Estell, W. S. Jackson, J. D. Mudge, D. McQuaig, and officials of the Duck Lake Mining Company for assistance rendered in the field in various ways.

Previous Work and History

The area is included in the general geological map, No. 964 on a scale of eight miles to the inch, which accompanies W. H. Collins' report on the region lying north of Lake Superior between the Pic and Nipigon rivers.[1] In 1914 the writer made a preliminary report[2] on the Big Duck Lake Area which was accompanied by a coloured geological map on a scale of two miles to the inch.

Among the early stakings in the area were the Martin locations Nos. 1 and 2 on Schreiber peninsula, which were surveyed in 1872 before the construction of the railway. The finding of gold on Victoria cape, Jackfish bay, led to other discoveries in the area, namely the Empress in 1895, the Otisse in 1896 and the McKellar in 1898. Gold was found at Big Duck lake in 1906, but little activity was shown until spectacular showings of gold were found on the McQuaig and Sjolander-McKirdy properties in 1914. In 1919 W. S. Jackson found narrow rich gold-bearing quartz veins in the vicinity of the Otisse, three miles east of Schreiber. This resulted in many claims being staked and the re-opening of the McKellar.[3] The Zenith zinc mine, although found about 1880, did not ship ore until the years 1899 to 1901. A trial shipment of iron pyrites was made from the Morley, near Schreiber in 1897. For the last ten years cobble stones and pebbles have been picked from the Lake Superior beach near Jackfish, and shipped to cement mills for grinding purposes.

Topography

The area is practically all rock with a few small areas of sand and gravel in the vicinity of Selim, Schreiber and Blue Jay stations. The shore line of Lake Superior is on the whole rocky, frequently rising abruptly for 200 or 300 feet, as

[1] Geological Survey of Canada, 1909.
[2] Ont. Bur. of Mines Report, Vol. XXIV, 1915, pp. 9-13.
[3] Now known as the McKellar-Longworth.

on the west side of Schreiber peninsula, thus presenting bold and striking scenery. Inland the rocky hills attain a height of 800 or 1,000 feet above Lake Superior, but the rise is often gradual. Usually the Keewatin hills are higher than those composed of granite. An ice sheet has passed over the tops of these high hills, the tops being polished and grooved and covered in places by a few feet of gravel and an occasional large erratic. Glacial rivers have apparently transported most of

Vein showing the southern part of Schreiber. The town is built on what appear to be delta deposits, and is nearly surrounded by rocky ridges, 200 feet in height.

Gravel terraces or old lake beaches, about one quarter of a mile south of Schreiber.

the material now forming the lake beaches which can be seen beautifully at Selim, Terrace bay and east of Jackfish station. The gravel beaches are not derived from the rocks 'in place'. The sand and gravel deposits on which Schreiber is located are apparently delta deposits formed from gravels brought down by glacial rivers. Blue Jay lake may have originated as a kettle lake. Certain of the beaches are followed by the railway right of way.

The magnetic and astronomic north are practically identical.

Timber, Waterpower, etc.

Owing to the rugged and rocky nature of the country there is no agricultural land whatever.

On the whole the trees are small. However in a few localities as at Schreiber peninsula, Victoria lake and north of Blue Jay lake the spruce, birch and poplar have attained a size of two or three feet in diameter.

Speckled trout and brook trout are plentiful in most of the small lakes and streams near lake Superior. It is reported that no fish have ever been caught in Big Duck lake.

Gorge below 90-foot falls, Black river, near Schreiber.

An excellent small power could be developed on the Black river directly south of the railway where the river has a vertical drop of about 90 feet. Schreiber at present is furnished with electricity generated by coal. Big Duck creek as it leaves the lake by the same name drops over a fall of about 75 feet, but only about 50 or 100 horsepower could be developed owing to the small volume of water.

General Geology

The compact rocks of the area are pre-Cambrian, which have been glaciated. They may be classified according to the following table, the oldest being placed at the bottom.

PLEISTOCENE

Glacial and Recent	Sand and gravel.

PRE-CAMBRIAN

Keweenawan	Quartz-diabase, olivine diabase dikes and sills. Basic amygdaloidal lavas. Conglomerate, tuff, red dolomite and limestone.
Animikie	Black shale, iron formation and conglomerate.
Algoman (?)	Quartz, feldspar—and granite—porphyry, schistose in places.[1] Hornblende and biotite granite and syenite, gneissic in places.[2]
Pre-Algoman (?)	Serpentine.
Keewatin	Felsite and rhyolite with subordinate basalt areas. Iron formation. Pillow lavas altered to hornblende, chlorite, carbonate sericite schists; rhyolite, agglomerate, tuff, diorite, horneblendite and felsite. Grey garnet, mica schists [Couchiching (?)].

[1] The badly sheared porphyries may be of older age than Algoman.
[2] The granite gneisses near Birch and Rope lakes may be Laurentian.

Keewatin

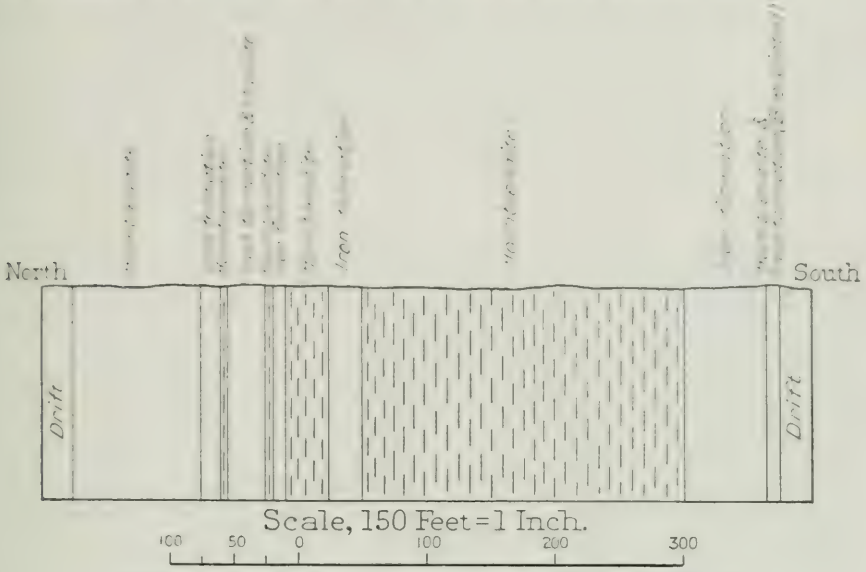
The Keewatin rocks occupy a considerable portion of the map area. In this group there are various types of rocks, and they are important since they contain most of the economic minerals.

The oldest rocks in this system are the banded grey mica schists, garnetiferous in places, which occur in the vicinity of Rope and Birch lakes. Somewhat similar rocks occur on the railway 2.4 miles west of Schreiber and on Ansel lake. They appear to be highly metamorphosed clastic rocks occurring near the periphery of the Keewatin, suggesting that they may be a basal portion of the Keewatin—probably Couchiching in age. In the vicinity of Loon lake the rusty-grey, quartzose mica schist and the Keewatin pillow lavas are intermixed and probably interbanded, over a width of a mile. The rocks are intruded by numerous pegmatite dikes.

The main portion of the Keewatin is basic pillow lava which has been highly altered to hornblende, chlorite, carbonate, sericite and other schists. Associated and interbedded with these flow rocks in places are rocks of an intermediate or acid character, felsite, tuffs, conglomerate and iron formation. Many of these rocks have been folded on end and entirely altered to secondary minerals. Pillow lava altering to serpentine can been seen on the south end of Cook lake and on claim A.L. 54. The prevailing strike of the schist is north-70°-east and the dip nearly vertical; however, in the vicinity of Schreiber the strikes vary considerably. At Victoria lake, five miles north of Schreiber, narrow bands of rhyolite, diorite, hornblende schist and iron formation are repeatedly interbanded as shown in the section. A sample of hornblende schist retaining a faint pillow structure on the McQuaig location shows under the microscope about 60 per cent. of hornblende partly altered to chlorite and replaced by quartz in a fine groundmass of quartz, sericite, calcite, chlorite, kaolin, epidote, magnetite and pyrite.

Diorite occurs in considerable volume in the vicinity of the Zenith mine and elsewhere. The rock has been separated on map No. 964 of the Geological Survey of Canada as an eruptive, and described on page 17 of the accompanying report No. 1081, by W. H. Collins as follows:—

A small area of diorite occurs on the Whitesand route, twelve miles north of Winston. The rock is fairly coarse, and rich in hornblende, sometimes approximating to an amphibolite. It contains both brown and blue-green hornblende, the latter fibrous, lime feldspar in laths, sometimes quartz, and commonly in the darker varieties masses of pyrite. The area is less than three miles across.



Section across Keewatin rocks exposed by a trench on mining claim T.B. 3575, five miles north of Schreiber.

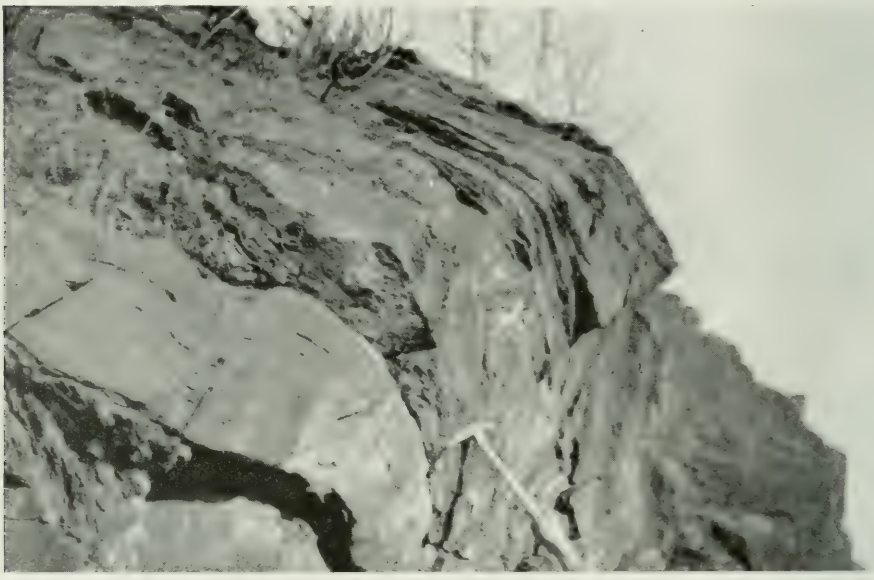
Diorite and amphibolite were found to occur in various parts of the Big Duck lake area. A coarse massive rock resembling diorite and occurring along the trail about one and one-half miles north of Louise lake, appears to be a basic phase of granite. Further north on claim T.B. 3452 the diorite becomes pegmatitic in character. In many parts of the Big Duck Lake area the diorite and hornblende schist (altered pillow lava) are so intermingled that it is almost impossible to map the diorite separately, particularly when the latter has been sheared. At Johnson lake, near the Zenith location, T. L. Tanton found the diorite to be massive close to the granite, and to be cut by pegmatite dikes.

Iron formation comprising narrow bands of chert, sugary quartz and magnetite and occasionally pyrite and pyrrhotite occur in several parts of the area. Five miles north of Schreiber a number of locations have been staked out on a long narrow band of iron formation from which low contents of gold have been obtained. Considerable prospecting for gold has been done on iron formation over various parts of the Province, but as yet has developed no appreciable quantity of ore. Narrow bands of grey limestone up to two feet in thickness with some slate and greywacké form part of the formation at Schreiber and on the railway about one mile to the southeast. These sediments at Schreiber are from six to eight chains in thickness, the strike being northwest-southeast and dip 60 deg. to the northeast. On the whole they resemble the Grenville of Eastern Ontario. Associated with the iron formation of the Morley, Jackson and Otisse claims is a graphitic schist. W. H. Collins refers to a vein of impure graphite on Rope lake. Banded cherts can be seen on the railway in the first rock-cut west of Schreiber and at a mileage 2.35 west of Schreiber.

A narrow band of conglomerate carrying obscure pebbles of chert, felsite and grey granite porphyry occurs on the railway one mile west of Schreiber.

The sediments, bounded on both sides by pillow lava, strike northwest-southeast, dip 50 deg. northeast, and in many ways resemble the Timiskaming conglomerate.

Felsite and rhyolite, pink to grey in color and apparently contemporaneous with the iron formation, outcrop in an area of three square miles directly to the south of Schreiber. Small areas of basalt have been included with the rock in mapping. About 380 yards southeast of the station, granite can be seen cutting the felsite. The rock is usually fine-grained, resembling chert in places, while elsewhere it has the texture of fine-grained granite. Under the microscope can be seen occasional feldspar and quartz phenocrysts in a fine-grained mass of the same minerals. In some places the rock is brecciated, and in others, it contains considerable disseminated iron pyrites.



Banded iron formation in a railway cut one mile east of Schreiber. The darker bands are impure limestone.

Pre-Algoman?

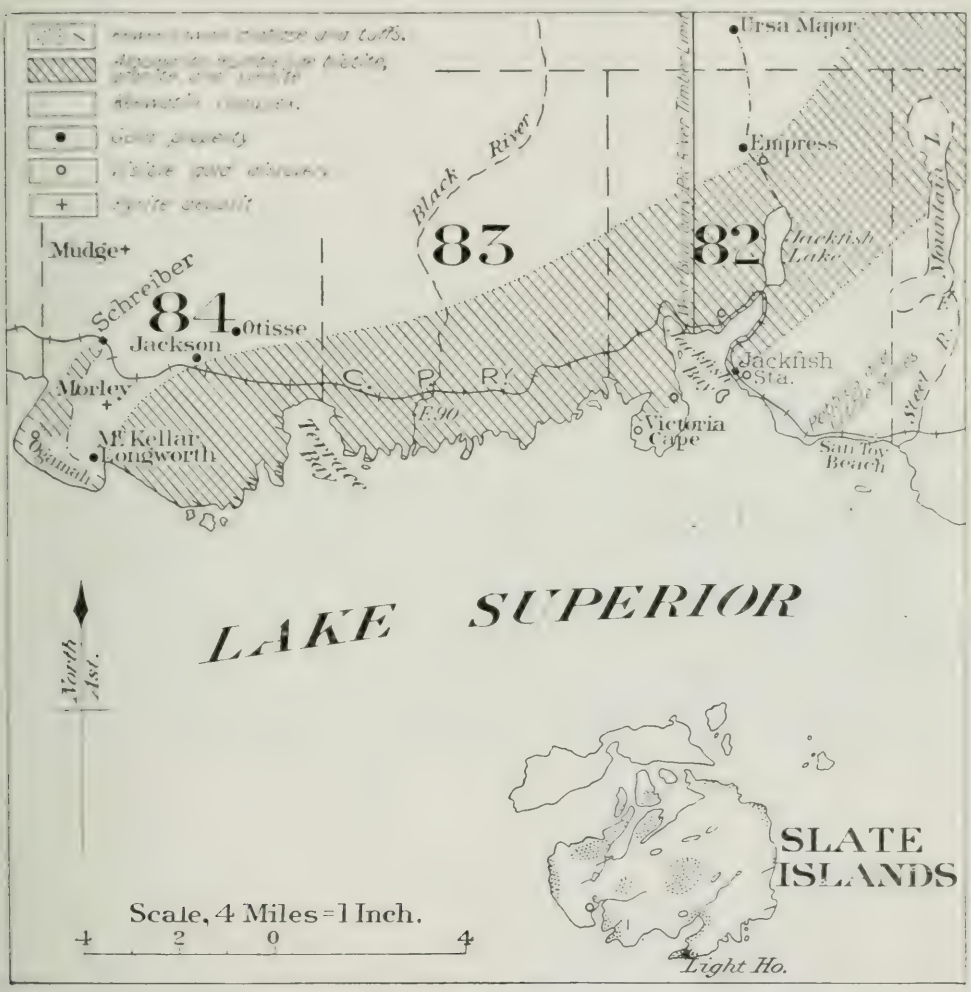
Serpentine.—Only one outcrop of serpentine was seen in the area, namely, on the south shore of Bear lake. It is clearly a dike, cutting typical Keewatin green schists, and is classed provisionally as pre-Algoman or Haileyburian, since it resembles in every way the pre-Algoman serpentines in many parts of northeastern Ontario. The serpentine contains some fine-grained magnetite and minute veinlets of asbestos. Under the microscope some of the serpentine has olivine outlines suggesting that it may be altered periodite.

Algoman?

After the Keewatin was regionally metamorphosed it was intruded by large masses and dikes of granite, syenite and porphyry, which in places enclose Keewatin fragments, and in other parts underlie Animikie sediments. The granite, which is usually in sharp contact with Keewatin, is massive and fresh looking, resembling Algoman granite. A few small granite-gneiss areas, probably of Laurentian age, occur at Rope and Birch lakes, where the rocks are intimately mixed with grey mica schists. Nearly all these acid plutonic rocks are massive, pink to grey in

colour, medium in grain and of the hornblende-biotite type. At Jackfish the rock is red hornblende quartz syenite containing fairly fresh microcline. In going westerly to Schreiber the syenite alternates with, and grades into, hornblende-biotite granite with feldspars showing little alteration, the accessory minerals being apatite, sphene, magnetite etc.

Extending along the northern edge of this granite-syenite mass from Jackfish bay to Schreiber peninsula, are found the chief gold deposits of the area. Gold has also been found at Victoria cape and Jackfish station, the two places where



Key map showing the relationship of gold deposits to a batholitic mass of granite and syenite near Schreiber and Jackfish.

the Keewatin-granite south contact is exposed. In addition to gold, there are many other minerals occurring in veins in the granite with a northwest-southeast strike. Copper pyrites and molybdenite occur in narrow quartz veins on R 655, R 656 and R 660. Fluorite, specular hematite and chalcedony are found in quartz veins at mileage 111.6, seven miles east of Schreiber. A narrow vein of barite and fluorite assaying 2 ounces of silver per ton can be seen in a fault at the 90-foot falls near the mouth of the Black river.

The wall rock on the McKellar-Longworth west vein on B.J. 122 is a red porphyritic hornblende syenite, the analysis of which is as follows:—silica, 59.82 ferric oxide, 3.67; alumina, 16.03; lime, 4.60; magnesia, 3.04; soda, 4.50; potash, 1.26; water (combined) 2.33; carbon dioxide 0.07. Total, 100.12 per cent.

Massive, porphyritic, hornblende-biotite granite, and syenite with red orthoclase crystals one inch across occur along the railway between Selim and Horn siding. The rock is pink to deep red in colour, and is cut by small dikes of aplite, pegmatite and porphyry, probably differentiation phases of the granite-syenite magma. Small veins of barite were noticed in the granite near mileage 7 on the railway.

The small exposure of grey hornblende granite on T.B.3576 at Victoria lake contains an abundance of disseminated iron pyrites.

Porphyries of various kinds occur in the area, but they are most prevalent in an area of eight square miles at Big Duck lake. Here they are dominantly

Thin sill of diabase cutting Animikie sediments, Winston point, Lake Superior.

of the light-grey quartz porphyry type, and occur as dikes and stocks up to a third of a mile in width. They vary from the massive, slightly unaltered type to the schistose highly altered variety. The much sheared calcareous quartz porphyries may be of an older age than the massive type, but they are grouped together on the map. The presence of so much calcite, sugary quartz and pyrite gives the rock a vein-like appearance as on T.B. 2091, 2123 and 3458. An occasional reddish quartz-feldspar porphry dike can be seen on T.B. 3250, 3324 and other claims. Under thin section the quartz porphyry is seen to contain large rounded phenocrysts of quartz, some being hexagonal in outline, with an occcasional microcline and biotite crystal set in a micro-crystalline ground-mass of quartz, calcite, chlorite, leucoxene, epidote and hornblende with some pyrite. The minute feldspars in the ground-mass are altered to sericite and other materials.

Fine-grained quartz porphyries or rhyolites, schistose in places, occur with the Keewatin between Maude and Lynx lakes.

Numerous dikes of granite, granite porphyry, feldspar porphyry, aplite, pegmatite, mica lamprophyre etc.—probably apophyses from the granite—cut the Keewatin rock in the vicinity of the Jackson gold location three miles east of Schreiber.

A quartz porphyry dike intrudes the Keewatin on the Morley claim, R. 606.

Animikie

Small erosion remnants of Animikie conglomerate, iron formation and black shale occur along the shore of Lake Superior between Winston point and Flint bay.[1] These rocks are the only known Animikie representatives on the north shore of Lake Superior east of Thunder Bay, and they may have been saved from complete erosion by a fault which extends along the shore at this place. The rocks which are cut by thin sills and dikes of diabase, have a total thickness of about 12 feet and dip from five to ten degrees to the south. The faintly altered sediments lie unconformably on the Keewatin green schists and Algoman (?) red porphyritic granite, notwithstanding the fact that the granite is in sharp contact with the iron formation and conglomerate, and that no granite pebbles occur in the latter.

The iron formation comprises banded silica and pyrite, chert, siderite and taconite. The black shale is oily in appearance, and contains thin layers and small nodules of iron pyrites. A few small veins of barite, calcite, amethyst, etc., cut the formation. On the easterly Animikie outcrop in Flint bay, a small float of pure hematite was observed.

Keweenawan

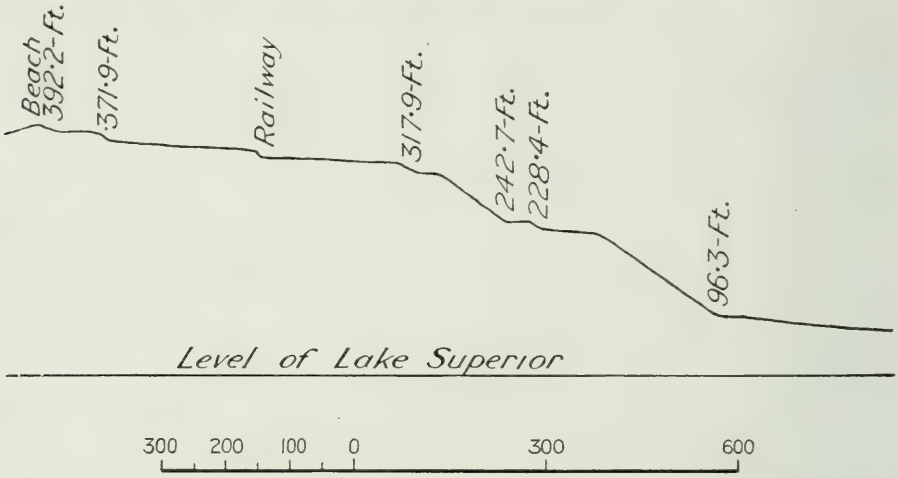
The Keweenawan comprises conglomerate, tuff, red dolomite and limestone (Nipigon sediments) conformably overlain by basic amygdaloidal lava flows, and cut by normal diabase and olivine diabase dikes and sills. The Nipigon sediments and amygdaloidal lavas in the map area occur only on Copper island, the geology of which was kindly furnished by T. L. Tanton, Geological Survey of Canada. On this island the flat-lying sediments strike 20 deg. south of east and dip 6 deg. or less south 20 deg. west. According to Mr. Tanton, small amounts of native copper occur in veinlets and amygdules in the lava on the northwest shore of the island. Diabase sills can be seen cutting the Animikie sediments on the main shore, directly north of Copper island. Normal diabase, quartz diabase and olivine diabase dikes are found cutting all the other formations in the area. The dikes appear to be most prevalent on Schreiber peninsula, where they have a constant strike of about 25° south of east, and dip vertically or plunge steeply about north 25° east. East of the map sheet between the Black river and Jackfish bay only a few diabase dikes were seen cutting the formation which is all granite and syenite, with the exception of a little Keewatin on the south end of Victoria cape, suggesting that the Keweenawan formation may not have extended this far east. A. L. Parsons, however, has mapped considerable Keweenawan diabase and tuffs on Slate island, 7 miles south of Jackson Station. Olivine diabase with a decomposed surface may be seen cutting the Keewatin pillow lava on the railway at mileage 5, west of Schreiber. A similar dike cutting the granite occurs one-half mile further west on the railway. A typical quartz diabase with beautiful ophitic texture occurs on the three-quarter mile portage on Big Duck creek. Under thin section the quartz is seen to occur in large grains and also intergrown with the plagioclase with some augite, magnetite, etc.

Glacial Deposits

Schreiber, 395 feet above Lake Superior, is on a sand and gravel delta deposit formed from material brought down by a glacial river. As Lake Warren receded,

[1] Otherwise known as Collingwood bay.

at least three beaches were formed to the south of the town, as shown in the illustration on page 2. Better preserved and more striking beaches occur at Selim, Terrace bay, and east of Jackfish. Many of the gravel terraces on the north shore of Lake Superior have been studied by A. C. Lawson.[1]



Profile of sand and gravel deposits at Terrace Bay, after A. C. Lawson, 1891.

Lake terraces, Terrace Bay, north shore of Lake Superior. From Agassiz's "Lake Superior." These gravel terraces are now covered by large trees. See Ontario Bureau of Mines Report, Vol. 7, p. 204.

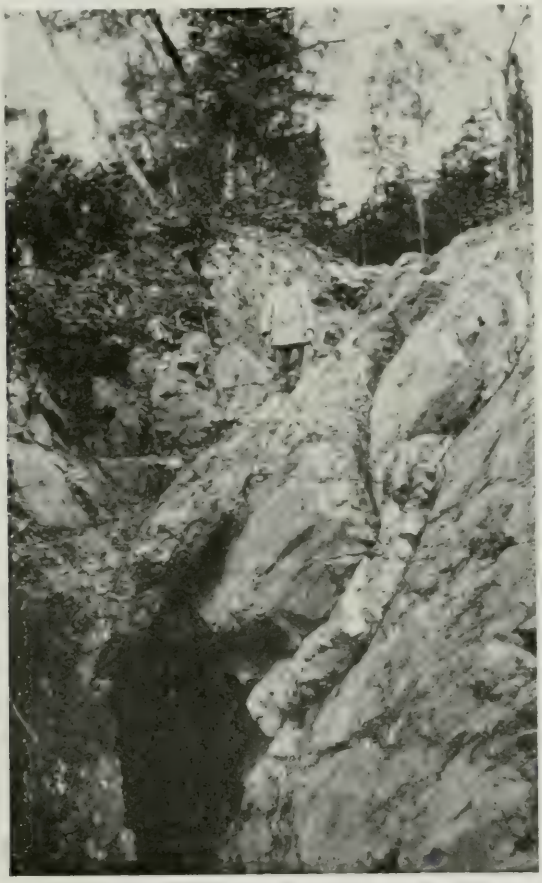
A pebble of Nipigon red dolomite was seen in the drift at Big Duck lake; similar pebbles were seen near the railway at Schreiber, but these may have been transported from ballast pits elsewhere.

[1] The Geological and Natural History Survey of Minnesota, 20th annual report, 1891, pp 183-289.

Economic Geology

The principal mineral sought for in the area is gold, which was produced at the Empress mine near Jackfish between 1896 and 1899. Small shipments of gold ore for test purposes have been made from the McKellar-Longworth, Otisse and Jackson properties near Schreiber, and from the McQuaig and Sjolander-McKirdy at Big Duck lake. During 1921 work was carried on at the McKellar-Longworth and Jackson prospects.

Iron pyrites is found in encouraging quantities on the Morley claim, south of Schreiber, and on the Mudge near Cook lake, but no shipments have been made apart from a car-load in 1897 from the Morley.



Tunnel on east vein, McKellar-Longworth claim (B.J. 122). The quartz on the right side of tunnel is 18 inches wide and carries considerable visible gold.

Zinc occurs as zinc blende in diorite at the Zenith zinc mine, eleven miles north of Selim station. Between 1899 and 1901, approximately 2,700 tons of ore were shipped.

Copper, occurring as chalcopyrite in quartz, can be seen in appreciable quantities at Big Duck lake; and native copper occurs in veinlets and amygdules in Keweenawan lava on the northwest shore of Copper island.

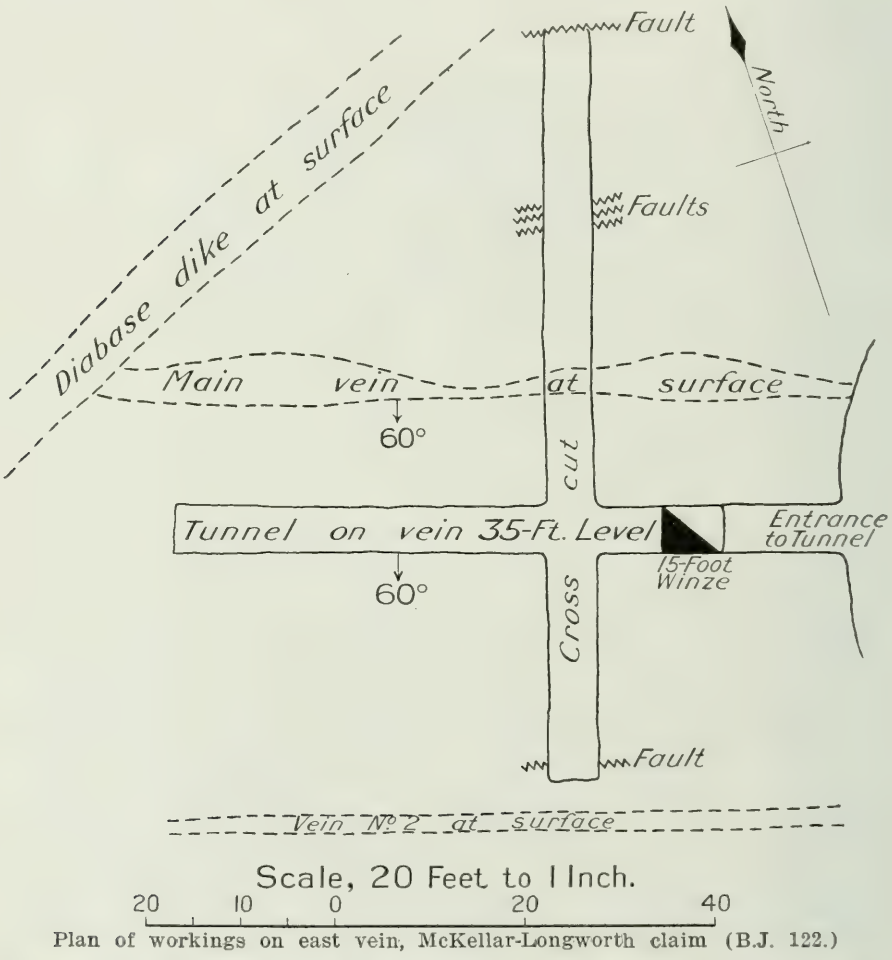
Large bodies of pyrrhotite occur in various parts of the area, but samples taken for examination showed no nickel, platinum gold or silver.

For the last ten years cobbles and pebbles have been selected from a gravel pit near Jackfish station and shipped to cement mills for use in grinding purposes.

The various deposits are described in the following paragraphs.

Gold Near Schreiber

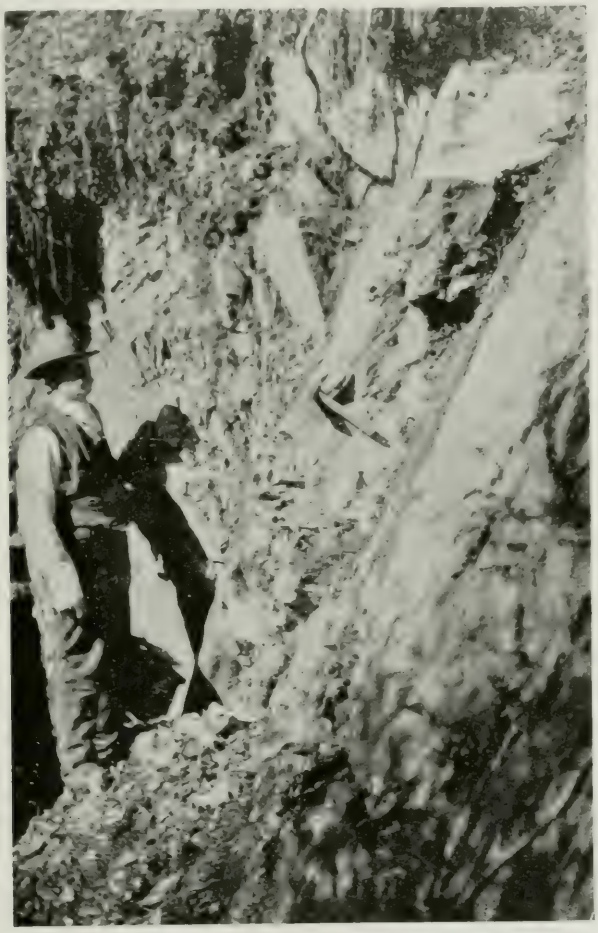
There are three properties containing good showings of gold in veins in Keewatin rocks near the contact of the granite batholith.



Plan of workings on east vein, McKellar-Longworth claim (B.J. 122.)

McKellar-Longworth.—The McKellar-Longworth 160-acre claim, B.J. 122, lies two and three quarter miles south of Schreiber. It was surveyed in 1898 and patented in 1903 by McKellar brothers of Fort William. The property is briefly referred to by Inspector J. A. Bow on page 89 of the tenth report of the Ontario Bureau of Mines for 1900, but owing to the claim number having been omitted and no work performed during the last twenty years, the deposit was difficult to locate. J. D. Mudge of Schreiber, assisted me by kindly drawing a sketch showing the locations of the old workings. A gold-bearing quartz vein striking approximately 10° south of east, and dipping about 55° south, can be traced for at least 200 feet. It varies in width from a foot to five feet, the

wider parts comprising quartz and schist. The quartz is milky and bluish in colour and contains considerable pyrite with some copper pyrites, malachite, pyrrhotite, galena and a little fine-grained arsenopyrite. Some feldspar and calcite are also present. Considerable visible gold, some of which is quite coarse, occurs with the sulphides and a greenish talc in the fractures of the quartz. A channeled sample, across eighteen inches of quartz in which no gold could be seen, gave on assay $40.00 in gold per ton. Many specimens with visible gold were seen on the moss-covered dump.

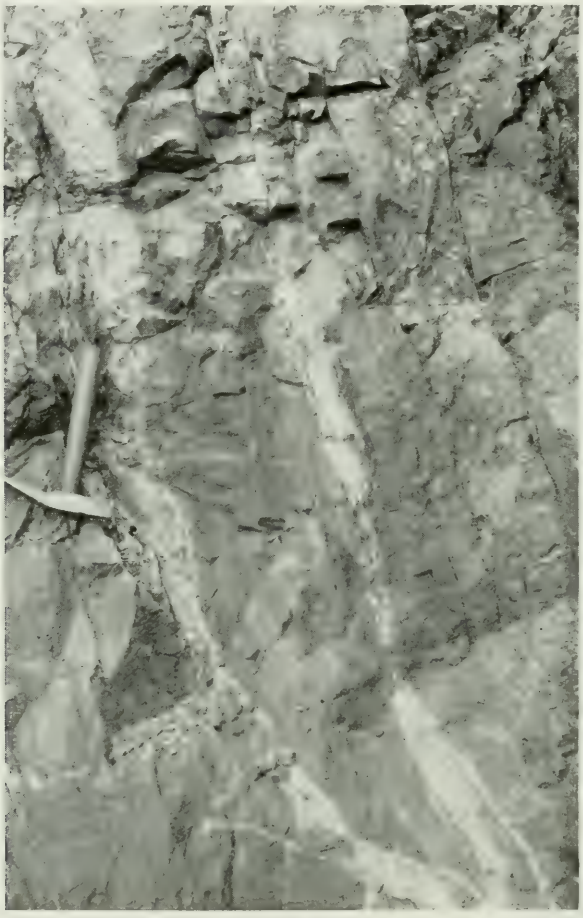


McKellar-Longworth vein carrying considerable visible gold, B. J. 122

In the autumn of 1920 W. L. Longworth, of Port Arthur, took an option on the property and kept 10 men employed during the following year. A good camp was built and a road cut out to the property and considerable exploratory work was accomplished. A plan of the underground workings of the east vein is shown on page 12.

In the northwest part of B.J. 122 and almost in a strike with the east vein a narrow rich vein has been uncovered in hornblende syenite. The finding of a quartz float containing visible gold by L. H. Estell led to the discovery. The

milky quartz is from 4 inches to one foot in width on the surface and carries considerable coarse gold in association with a grey telluride which has not yet been definitely identified. At a depth of 25 feet Mr. Longworth reports that the vein is two feet wide and carries considerable visible gold. The wall rock is a massive red porphyritic hornblende syenite. In 1921 a deposit of schist and quartz 12 feet in width was uncovered midway between the east and west veins. All three veins appear to be in one large shear zone. The results of the exploration to date are very encouraging.



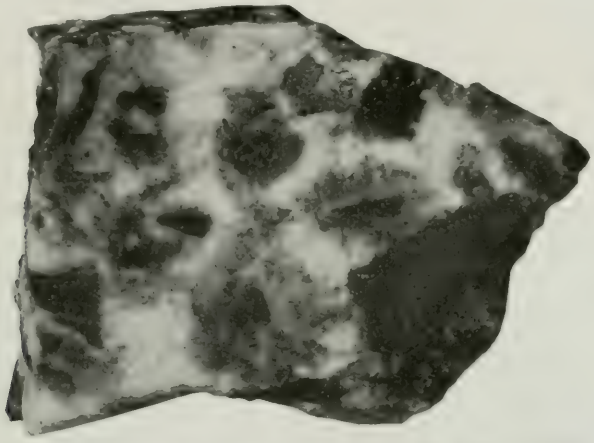
A pit on the Jackson claim, T. B. 3326, showing branches and lenses of gold-bearing quartz.

The rocks on the property are largely Keewatin chorite schist and felsite, and Algoman hornblende syenite and porphyry.

Mr. Mudge stated that in or about the year 1900 an Indian named Ogama found gold about one and one-quarter miles northwest of the McKellar-Longworth.

Jackson.—The Jackson-Hartness claims (T.B. 3327 and T.B. 3354) and the Jackson-Russel claims (T.B. 3326, etc.) are grouped under this one head. Claims T.B. 3326 and 3354, on which the richest showings are found, are restaked

portions of two abandoned surveyed claims, 500 x and R. 125, which are situated three miles east of Schreiber and directly north of the railway. The obtaining of a high assay from a piece of quartz float led to the discovery of several narrow parallel gold-bearing veins two of which contain rich showings of gold. The veins strike N.E.-S.W. and dip 80° northwest along the edge of a large hill of Keewatin lavas, diorite, iron formation, etc. At the base of the 200-foot hill is Algoman hornblende granite and syenite which extends four miles southerly to Lake Superior. Dikes and sills of granite with differentiation facies, namely, porphyry, hornblende syenite, mica, lamprophyre, aplite, etc., penetrate the Keewatin for several hundred yards from the contact. The veins cut these rocks and occasionally lie in the contact; however, two narrow diabase dikes of Keweenawan age intrude the veins.



Polished sample (natural size) of high grade gold ore from Jackson claim, T. B. 3354. The large dark crystal in the lower right hand corner is pyrite containing numerous veinlets of native gold.

The veins are 600 or more feet in length, average a few inches in width and are frequently spaced 10 feet or more from one another. The quartz in places widens to 1½ or two feet or splits up into several veinlets across a width of 5 or 6 feet.

The vein material is quartz and pyrite carrying in places small amounts of galena, zinc blende and copper pyrites, and a very little molybdenite. The pyrite frequently occurs as large cubes, an inch across, carrying visible gold. Calcite and small angular inclusions of green schist are also present—giving a brecciated appearance. One of the larger veins contains considerable dolomite. The richest ore comes from two veins, 25 feet apart and near the line between T. B. 3354 and T.B. 3326 and on either side of a narrow diabase dike.

At a point about one chain west of where one of these veins crosses the east line of T.B. 3354, the vein is 1½ feet wide and will assay about $100.00 in gold and 3 ounces in silver per ton. At this place a pit has been put down on the vein from which one ton of ore was bagged and shipped to the School of Mines, Kingston, Ontario for a stamp-mill run and a laboratory cyanide test.—G. J. MacKay, Professor of Metallurgy reported as follows:—

Value per ton 5.61 ounces ($115.90) of gold and 3.21 ounces of silver. By stamp mill and amalgamation 61.9 per cent. was extracted as bullion, 24.4 per cent. was recovered in the concentrate and 13.7 per cent. was left in the tailings. Both the concentrates and the tailings cyanide readily.

Similar high-grade material was obtained from a pit about 50 feet farther down the hillside.

Further east on these two veins and on the west side of T.B. 3326 a 30-foot tunnel has been driven into the hilside, exposing excellent showings of gold, one of the veins being 2 feet in width at this point. The deposits are worthy of further prospecting which may be done advantageously by means of tunnels, shafts and drifts.

Mr. Jackson reports that the sand and clay in the flat directly below the veins will pan well in gold.

Otisse Claim, T.B. 3412.—Gold was found on the Otisse claim, A.L. 217, four miles east of Schreiber in the fall of 1896. The claim with others adjoining was held by the Otisse Mining Company, and considerable work was done during the following year. Two shafts 1000 feet apart, were sunk 39 and 52 feet respectively, on a vein striking northeast-southwest, and dipping vertically in Keewatin basalt, rhyolite, diorite, iron formation etc. According to A. B. Willmott,[1]

The south shaft on the Otisse gold mine, as it appeared in 1898.

"the quartz vein at the northerly number one shaft is four feet wide and blue-grey in colour, having considerable pyrite and a little visible gold. The southerly pit number two, has two and a half feet of quartz and contains a little pyrrhotite. A mill test of one ton made at Kingston gave $15.53 as the value of the free gold and concentrates. A sample taken for assay gave $15.00 per ton at the School of Science." The deposits resemble altered iron formation well mineralized with pyrite and cut by secondary veinlets. A little graphite and galena were noticed in the quartz. A grey quartz feldspar porphyry dike lies directly east of the north shaft. No mining has been done in the last twenty years, but the claim has recently been restaked by W. S. Jackson as location number T.B. 3412. The old workings are referred to by Inspector J. A. Bow.[2]

Gold Near Jackfish Bay

The granite-syenite batholith, near the north edge of which are the McKellar-Longworth, Jackson and Otisse gold properties in the vicinity of Schreiber, extends easterly for thirteen miles to Jackfish Bay, where gold is also found

[1] Ont. Bur. Min. Report, 1898, Vol. VII, p. 134.

[2] Ibid, p. 80.

under somewhat similar conditions. At the latter place, the Empress, which produced gold in 1896-1899, the Ursa Major and other properties occur in the green schists near the granite as at Schreiber. Gold has also been found where the green schist is exposed on the southern edge of the granite batholith, namely at Victoria cape and at Jackfish station and 7 miles further south on Slate islands. Ben Almis is also reported to have discovered gold at Bottle point, 6 miles east of Jackfish. The first noted gold discovery described on the north shore of Lake Superior was found on Victoria cape. The Slate Island gold deposits are described by A. L. Parsons.[1]

Plan of underground workings of the Empress gold mine. At the bottom of the 51-ft. winze is a drift 100 ft. in length.

Gold also occurs in the granite batholith, *e.g.* on the road at a point about one half mile southeast of the Empress mine. A. P. Coleman[2] also refers to gold in the granite as follows:—"Three-quarters of a mile west of the tunnel [mileage 103 on the railway, near Jackfish bay] a small quartz vein is found in the granite. Some years ago, as Mr. McKellar reports, rich gold specimens were obtained from it: but there was not enough quartz to justify mining it." The Empress and Ursa Major are briefly described in the following paragraphs.

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[1] Ont. Bur. Min. Report, Vol. XXVII, 1918, Part 1, pp. 155-167.

[2] Ibid, Vol. V, 1900, p. 84.

Empress Gold Mine:—The Empress Mine, R569, was discovered in June 1895 by an Indian who brought specimens to D. McKellar of Fort William. The property lies four miles from the railway and two and a half miles inland from the north end of Jackfish Bay. The gold deposits are near the northern side of a batholith of Algoman (?) granite and syenite and situated in Keewatin hornblende, chlorite, talc, and sericite schists which still retain faint pillow structure. They comprise numerous lenses of quartz up to eight feet in width on the southern slope of a large hill, striking east-northeast and west-southwest and dipping 60° to the south. There are five quartz schist bedded veins in a width of 400 feet, the northerly vein being the richest. The quartz contains much pyrite, some calcite, chalcopyrite, zinc blende, galena and a little native copper, but little visible gold, although some rich showings were said to have been found. The pyrite is more abundant in the schist than in the quartz. According to A. P. Coleman,[1] "Assays of four samples of the ore ranged from $1.00 to $4.00, averaging $2.50 per ton. The concentrates containing a good deal of sand, yielded $6.00 per

Mill of Empress Gold Mine.

ton." The veins have been cross-cut by a tunnel 417 feet in length and some drifting and stoping has been done. A 51-foot winze was sunk on the southerly vein, at the bottom of which a 100-foot drift was run. In addition, the veins have been trenched and exploited by means of shallow pits. An amalgamation and concentrating 10-stamp mill was erected in 1896, which treated thirty tons daily when operating. Seventy-five per cent of the gold was free-milling. The mouth of the tunnel is high enough to run the ore by gravity to the top of the mill, thus affording cheap mining and milling. The prospect has remained closed since December 20th, 1899. References to the property may be found in the following Ontario Bureau of Mines Reports.[2]

Several locations were taken up on extensions of the Empress vein, the *Gaddes* on the east and the *Macon* on the west. Further south in the granite is the *Megatherium* property which has a small white quartz vein carrying a little pyrite, chalcopyrite and galena which show the presence of gold on assay.

[1] Ont. Bur. Min. Report, Vol. VII, 1897, p. 135.

[2] Vol. V, 1895, p. 84, 85, 104, 189; Vol. VI, 1896, p. 56, 111, 263; Vol. VII, 1898, p. 81, 135; Vol. IX, 1900, p. 82; Vol. X, 1901, p. 87.

Ursa Major.—The Ursa Major (A.L. 219, 220) is situated on a government wagon road, three miles north of the Empress. Work commenced in August 1898 and ceased in 1900. According to Inspector J. A. Bow[1] the work consists of a shaft 121 feet deep with a cross-cut 88 feet north at the 118-foot level. The dump is schist mineralized with much pyrite. About 400 feet northeast of the shaft is a large quartz vein six to twenty feet in width, and striking a hundred and ten degrees for several hundred feet. The quartz is glassy and contains considerable iron and copper pyrites and galena, yielding on assay low values in gold. The wall rocks are green chlorite and mica schists striking northwest-southeast and cut by an occasional acid dike. The property is briefly referred to in the following departmental reports.[2]

Other properties in the vicinity are the *Jackes* (R686), *Polaris* (M23) and *McQuaig* (R692).

The area in the vicinity of this granite-schist contact extending all the way from Schreiber to Jackfish bay should be worthy of careful prospecting for gold deposits.

Big Duck Lake, looking northeast.

Slate Islands.—Rich specimens of gold have been found on various parts of Slate islands, seven miles south of Jackfish station, but according to A. L. Parsons the deposits are not promising. The richest deposit, the location of which is indicated on the map on page 7, is described by Mr. Parsons[3] as follows:—

On the west side of St. Mary's bay is a vein with a width varying from 4 inches to 8 inches. In this vein visible gold was found, and samples the entire width of the vein were taken for assay. It is believed that these samples represent the maximum value that can be expected from any quantity of ore that might be mined from this vein. Selected samples might be taken which would yield much greater values The quartz is white and milky and the length as shown by numerous test pits is not less than 400 feet. Three samples were taken for assay, yielding $15.40, $0.00 and $3.20 per ton.

Gold at Big Duck Lake

Big Duck Lake lies 14 miles due north of Schreiber and can be reached from the latter place by a rough winter road or by the Big Duck Creek water route in which there are 6 miles of portages. An easier canoe route is by way of Whitesand, Lynx and Charlotte lakes from Selim station.

Gold was found to the northwest of Big Duck lake in 1906 by a trapper, Joe Fisher. One claim was sold to D. McQuaig of Schreiber in 1913 and the other to C. Sjolander and W. McKirdy of Nipigon in 1914. The rich gold showings which came from these two claims resulted in many claims being staked

[1] Ont. Bur. Min. Report, Vol. X, 1901, p. 85.
[2] Ibid., Vol. VIII, 1899. p. 95; Vol. IX. 1900, p. 83.
[3] Ibid., Vol. XXVII, 1918, part 1. p. 166.

there during 1914; however, visible gold was only reported to have been found on one other property, namely the Estell claim or T.B. 1909. Low assays can be obtained from a number of deposits and gold can be panned freely from a decomposed pyrite-calcite vein on the Longworth claim T.B. 3250. Numerous shallow pits have been sunk in an area four miles in length extending from the west end of Little Duck lake to the east end of Big Duck lake and two miles in width. The porphyry intrusions are also confined mainly to this area. Much rock is exposed and the country is easy to prospect. On the drift-covered portions the soil is distributed fairly evenly, having an average thickness of two or three feet. Apart from the Longworth and a few other claims only a little trenching has been done. Approximately 75 claims have been surveyed.

The rocks are largely pillow lavas altered to hornblende, chlorite, biotite and carbonate schists striking east and west and dipping from the vertical to sixty degrees to the north. There are also massive diorites and hornblendites, some of which may be younger than the Keewatin. These are intruded by stocks and dikes of quartz porphyry up to one third of a mile in width, and by an occasional red feldspar porphyry dike, Algoman? in age. The highly sheared quartz porphyries may be of Keewatin age. The gold deposits occur in the rocks of both ages and are cut by Keweenawan diabase dikes.

The gold-bearing veins occur as lenses in the hornblende schist near the quartz porphyry, at the contact of the two rocks and in the quartz porphyry. The two principal deposits, the Beaver (McQuaig) and the Sjolander-McKirdy, are largely replacement deposits in which the gangue mineral is nearly all calcite with considerable included schist and only a few quartz veinlets. Considerable gold in a fine flour state can be seen in places; but samples taken a short distance from the gold showings usually gave low values on assay, indicating that little gold is present in the veins unless it can be seen. There are also a few large veins of the granular sugary quartz type which carry gold in small quantity. The gold appears to be genetically connected with the porphyry. The veins should be extensively trenched and sampled with the hope of locating isolated ore shoots.

McQuaig or *Beaver* (T.B. 1686).—The McQuaig deposit is largely calcite occurring in a narrow quartz poryphyry schist dike which intrudes Keewatin hornblende schist. The vein strikes east and west for 250 feet, and dips 70 degrees to the north. At the shaft there are 40 inches of calcite with an additional three feet of porphpry schist, replaced by carbonate and cut by calcite stringers on the hanging wall. An occasional quartz stringer cuts across the deposit. Both the vein and porphyry appear to end at a point about 150 feet west of the shaft. In the calcite are pyrite, coarse zinc blende, fine galena, some chalcopyrite, biotite and talc, the pyrite being altered in places to limonite. At a depth of six feet considerable gold in a fine flour state could be seen over a width of 10 inches near the centre of the foot wall section of the vein. In 1915, a small open cut was made and a 40-foot shaft sunk from which 2710 pounds of ore were sorted and shipped to a smelter yielding 2.0 ounces of gold and 3.9 ounces of silver per ton, total value $13.00 per ton. Visible gold was reported to occur at frequent intervals to the bottom of the shaft, where the vein was said to be about four feet wide.

Sjolander-McKirdy (T.B. 1861, 1955).—The Sjolander-McKirdy deposit, which lies 70 chains to the northeast of the McQuaig is in a hornblende schist which retains faint pillow structures and is distant about 800 feet to the north of a large quartz porphyry outcrop. The deposit strikes south-70°-west and dips 75° to the north, coinciding with the strike and dip of the country rocks. The

vein has not been traced continuously for any great distance. Near the east part of T.B. 1861 an open cut eight feet deep has been blasted for 24 feet across the entire width of the deposit. Assays of channel samples taken in sections across this open cut indicate favourable values in gold across seven feet near the hanging wall part. Considerable gold in a state of fine division occurs about five feet from the hanging wall. Much pyrite, some galena, zinc blende and chalcopyrite are disseminated throughout the calcite-quartz-schist vein. A thin section of the gold-bearing material shows interlocking quartz and calcite grains with gold and pyrite, closely associated, lying between the grains. In the early part of 1915, 500 pounds of the vein matter were shipped to a smelter. A vein on the east claim, T.B. 1955 contains molybendite.

A vertical face of the Sjolander-McKirdy gold deposit consisting of hornblende schist, calcite quartz, various sulphide, visible gold, etc. on claim T.B. 1955, Big Duck Lake.

Other Gold Deposits.—Other deposits which resemble the Sjolander and which occur in the same approximate strike are the *Fisher* (T.B. 1862), *Estell* (T.B. 1909) and the *Madson* (T.B. 2103). On the Fisher a diabase dike intrudes the vein. The Estell deposit comprises eight feet of dark and light coloured carbonate schists carrying pyrites and cut by veinlets of quartz up to five inches in width. The owner reported he had found coarse gold in the vein. A sample across five feet of the Madson vein yielded on assay $2.50 per ton in gold and nothing in silver. This vein consists of banded calcite, pyrite, sugary and glassy quartz.

Gold can also be panned from the *Longworth* "mud" vein on claim T.B. 3250. The circuitous vein which strikes northeast-southwest for 200 feet and dips from 60° to 80° southeast occurs in hornblende schist, and altered basic pillow lava. The vein is from one to three feet wide and consists of brown and yellow soft iron oxide carrying fragments of mica, calcite, pyrite and some galena and quartz. At depth the decomposed material will probably give way to calcite and pyrite, etc. Similar decomposed material was noticed in the McQuaig, Fisher and other deposits.

A somewhat different type of deposit, namely large lenses of granular or sugary quartz up to thirty feet in width with disseminated iron and copper pyrites and some galena and feldpar, occurs on the following claims: *Duck Lake Co.* (T.B. 3184, 3304), *St. Louis* (T.B. 3353) and *Cooper* (T.B. 3382). These veins are

indicated on the map. Samples from portions of them give low values in gold on assaying.

According to W. H. Collins[1] "a small gold nugget belonging to Mr. Dampier of Rossport, is said by him to have been taken from a quartz vein on Hornblende lake."

Copper at Big Duck Lake and Elsewhere

Estell Copper Claims (T.B. 1911, 3144, 3145).—These claims which are situated on the south shore of Big Duck lake, are owned by L. H. Estell of Schreiber. By means of several trenches a quartz vein some 12 or 15 feet in

The Longworth "mud vein" comprising limonite, calcite, pyrite and mica, from which gold can be panned. T.B. 3250, Big Duck Lake.

width has been traced for one-half mile across portions of the three claims. The vein strikes nearly east and west, and dips about seventy degrees north in hornblende schist. The vein consists of faintly banded sugary quartz cut in places by veinlets of glassy quartz, and carrying iron and copper pyrites, copper carbonates and a little molybdenite. Portions of the vein have considerable copper present and two samples assayed 40 cents in gold per ton. A similar vein carring a little calcite lies a little to the south on claim T.B. 1911.

[1] Geo. Sur. Canada, 1909, Report 1081, p. 21.

Burstrom Copper Claim T.B. 2091).—On this claim, which is situated one quarter of a mile west of Big Duck lake, is a lenticular copper-bearing granular quartz deposit some 20 feet by 15 feet in size at the contact of the hornblende schist and quartz porphyry, and cut by a Keweenawan diabase dike. An open cut 22 feet long and a shaft 25 feet deep has exposed a width of about seven feet near the centre of the deposit which will assay approximately four per cent. in copper. The deposit contains disseminated iron and copper pyrites, some hornblende schist and will yield on assay 20 cents in gold per ton.

A little disseminated copper pyrites and magnetite occur in a 3-foot vein of pyrrhotite on T.B. 3452, one mile southwest of Big Duck Lake.

Considerable chalcopyrite occurs in narrow quartz veins with molybdenite and other minerals on the *McKenzie* claim (R. 660) southeast of Schreiber, and in the *Blanchford* vein about three-quarters of a mile to the northeast of the McKenzie. Both these veins are in red hornblende granite and syenite. W. S. Jackson discovered small pockets of copper pyrites in Keewatin green schist on the east shore of *Ellis lake*. According to T. L. Tanton small amounts of native copper occur in veinlets and amygdules in the Keweenawan lavas on the northwest shore of *Copper island*.

Pyrrhotite on Nickel Lake and Elsewhere

In the autumn of 1914, large deposits of massive pyrrhotite and quartz and disseminated pyrrhotite were examined on Nickel lake which lies north of Big Duck lake at the extreme north end of the map sheet. Considerable work has been done on these deposits, which occur in granite-gneiss and grey schist, probably of Laurentian or Couchiching age. Moiled samples across three of these deposits yielded on assay, gold none, silver none, nickel none, platinum none. A moiled sample across five feet of pyrrhotite on the Henry Davis claim one mile east of Nickel lake, gave an assay: gold none, silver none, platinum none, and nickel trace.

Other pyrrhotite deposits were seen on the following claims:—T.B. 1894, T.B. 3452, R. 606 (Morley), E. 203, R. 658 and T.B. 3412 (Otisse). Large deposits are also reported by Jake A. Davidson to occur on the east side of Ducett lake, eight miles northeast of Schreiber. Pyrrhotite alone is of no economic value. However if large masses can be found associated with serpentine or some other basic rocks like norite or diabase, one should always look for some of the following minerals associated with the pyrrhotite:—nickel, copper platinum, gold or silver.

Zinc

Zenith Mine.—The Zenith mine (30 T) is situated about 11 miles north of Selim station, and four miles southwest of Big Duck lake. The property was discovered and taken up by the McKellar Brothers of Fort William about 1880, but remained dormant until 1899. Between 1899 and 1901 approximately 2,709 tons of zincblende were mined and hauled in winter to the railway for shipment. Much zinc still remains on the dump. According to Inspector W. E. H. Carter[1] the zinc blende occurs in small lenses which strike north and south and dip about twenty-five degrees east into a hill of trap [diorite]. The largest lens is twenty feet by fifteen feet. The property has been idle since 1901. W. L. Uglow[2] has given a summary report on the mine.

[1] Ontario Bureau of Mines Report, Vol. X, 1900, p. 110.

[2] Ibid., Vol. XXV, 1916, Part 2, pp. 7 and 8.

Gesic.—The Gesic (E.S. 79) is a small prospect situated about two miles south of the Zenith on the road to the railway. The vein on which a 23-foot shaft was sunk in 1900 is said to strike east and west, and dips 55° north. It contains zinc blende in promising quantities.[1]

Zinc blende occurs in small quantities in many veins in the area namely:—McQuaig, Sjolander-McKirdy, northeast shore of Little Duck lake and on the Jackson.

Part of the Zenith mine workings, showing where numerous zinc blende pockets have been worked from the hill side.

Iron Pyrites

Morley.—The Morley pyrite prospect, R. 606, lies one and one-half miles southeast of Schreiber station, and one and one-half miles north of Lake Superior. A prospector named Morley sold the claim in the spring of 1897 to the Davis Sulphur Ore Company of New York, who did considerable work during the year and made a trial shipment which gave good satisfaction. The deposit consists of pyrite and pyrrhotite in a Keewatin pinkish felsite, near which is Keewatin iron formation, and a dike of Algoman quartz porphyry, all of which have been cut by a Keweenawan diabase dike. To the south of the diabase dike pits have been sunk on sugary iron formation, but no solid iron pyrites was encountered. The main deposit strikes a little west of north and dips about 65° to the east. A trench reveals a lens of pure iron pyrites about fifty feet long and three feet wide, with a similar sized lens of pyrrhotite adjoining it on the west or foot-wall side. The pyrrhotite contains a little pyrite and chalcopyrite. Twenty-five feet to the east and further down the hill-side, a shaft, now filled with water, has been sunk on a parallel lens. At the bottom of the hill a short tunnel has been driven into felsite containing disseminated pyrrhotite. A little further northeast on a creek bank a pit has been put down on graphitic schist. About 200 tons of pyrite of good grade is piled in one dump and considerable pyrrhotite occurs in other parts of the

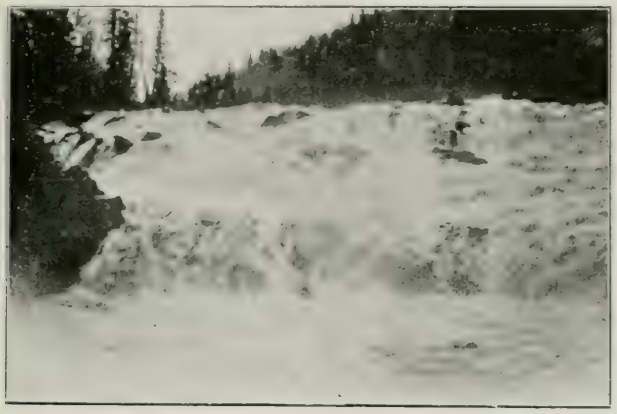
[1] Ont. Bur. Mines Report, Vol. IX, 1900, p. 87, by Inspector J. A. Bow.

dumps. The property is referred to by J. A. Bow, A. B. Willmott and E. L. Fraleck respectively in certain reports of the Ontario of Mines.[1]

Mudge.—The Mudge claim, T.B. 1048, on the northeast end of Cook lake and one mile north of Schreiber, was formerly a portion of the Otisse pyrite claim 776 X, referred to by E. L. Fraleck on page 177 of his report as follows.[2]

A heavy fahlband strikes east and west for about a mile. The gossan capping had in several places been removed and test pits sunk. The largest of these was about 12 feet deep and 12 feet long across the strike of the deposit, which is here seen to consist of a very fine grained mixture of pyrite, pyrrhotite and silica (banded). An average sample of the dump yielded 32.26 per cent. of sulphur.

The pyrite formation gives way in places along the strike to iron formation, banded magnetite and quartz, on either side of which is Keewatin pillow lava impregnated with calcite.



Falls on Steel river at the outlet of Mountain lake. *See* Volume 9, Ontario Bureau of Mines Report, p. 112.

Running northeasterly across Sulphur lake, as shown on the map, is a banded deposit, some 2 miles in length, of sugary quartz and pyrite. Veins of pyrite up to two feet in width and carrying low values in gold were noticed, but these are too small to mine for the sulphur contents. Narrow pyrrhotite veins are also present.

Argentiferous Galena

In 1921, Mr. Darling, of Schreiber, located an argentiferous galena vein on the railway 1½ miles to the west of Middleton station, or approximately 30 miles east of Schreiber. According to J. G. Cross, of Port Arthur, the galena vein in 2 inches in thickness and contains a little native silver. It occurs in a Keweenawan diabase dike about 200 feet in width.

Pebbles and Cobble Stones near Jackfish

At San Toy beach on the north shore of Lake Superior, three miles east of Jackfish station on the Canadian Pacific Railway there is a large pebble beach and gravel pit in which occur rounded cobbles and pebbles suitable for use in grinding in cement mills. During the years 1911-1915, Mr. Whalen of

[1] Vol. VII, 1898, Part 1, pp. 78, 80; Idem., Part 2, p. 134; Vol. XVI, 1907, p. 177.
[2] Iron Pyrites in Ontario, Ont. Bur. Mines Report, Vol. XVI, 1907, p. 177.

Port Arthur used a steam shovel and had several men bagging these pebbles along the shore and from points about 100 feet inland. The pebbles were shipped in boats to points on the Great Lakes.

Operations ceased in 1915 after considerable loss had been encountered in loading, owing to the lack of harbour facilities. One of the employees, C. W. Todesco of Jackfish, Ontario, obtained permission from the Canadian Pacific Railway Company to select pebbles from the adjoining gravel pit at San Toy siding. During the summer seasons about eighty tons a month of one, two and three-inch pebbles were shipped to the Canada Cement Company at Montreal and Winnipeg, bringing about $10.00 a ton. Some of the three-inch and four-inch cobbles would be suitable for grinding ore in the tube mills of Porcupine, Kirkland Lake, etc. The pebbles comprise granite, flint, trap, etc. Certain portions of the shore for thirty feet inland and the high banks of the Steel river directly north of the railway contain excellent unpicked pebbles.

ECONOMIC DEPOSITS IN THUNDER BAY DISTRICT

By A. L. Parsons

During the summer of 1920 the writer was engaged in the investigation of certain mineral deposits in the districts of Thunder Bay and Rainy River, paying particular attention to the iron deposits near Kaministikwia and Mokomon and the silver deposits of Silver islet and to the west of Port Arthur.

Iron Deposits

The Kaministikwia iron range is located principally in the townships of Ware and Conmee and apparently consists of the outcrops of a great synclinal fold which forms the walls of the Kaministiquia valley at this point. Magnetometric[1] and geological[2] maps of the range have been prepared by A. H. A. Robinson who shows not only the probable extent of the iron deposits, but locates the outcrops of ore, greenstone, and other rocks. Comparison with other similar deposits would seem to place these deposits in the Keewatin formation as they are intimately associated with greenstones and pillow lava which are practically identical with rocks of this age found in other localities. There are, however, no contacts with rock of other formations, so that it is impossible to state definitely the age. The deposits consist principally of banded magnetite and jaspilyte together with some hematite. The field examination proved them to be extensive and for the most part easily worked. In the preliminary stages open quarry work would permit of extensive development. The outcrops, however, are for the most part low grade and must be beneficiated by magnetic or other concentration.

Concentration and Analysis

Samples for analysis and concentration experiments were taken from claims 8 H and 393 R, Conmee township and 333 R, Ware township. The samples were crushed and each sample divided in three parts, the first for analysis of the natural ore, the second as taken from the crusher for concentration and analysis of the products, and the third, after being ground to pass 100 mesh, for treatment like the second. The analyses of the crude ore which were made by W. K. McNeill, Provincial Assayer, follow:—

	1 (8H)	2 (393R)	3 (333R)
SiO_2	50.64	43.10	40.90
Fe_2O_3	26.37	28.54	28.41
Fe O	15.89	14.26	13.09
S	0.16	0.12	0.19
P	Tr.	Tr.	Tr.
Fe	30.1094	30.5308	29.6182

These analyses confirm the estimate that was made in the field of the apparent grade of the ore and are only slightly lower in iron content than the figures that had been given by one of the owners.

[1] Map 409, Mines Branch, Dept. of Mines, Canada, 1914-15.
[2] Map 410, Mines Branch, Dept. of Mines, Canada, 1914-15.

The concentration of the ores for further analysis was kindly done by Prof. F. C. Dyer of the University of Toronto.

Sample No. 1 (8 H) when crushed to one quarter inch and put through a Wetherill magnetic separator gave four products which yielded the following results on analysis:

	(1)	(2)	(3)	(4)	loss
Amp.	.03	.05	.07	.....	.....
Weight, grams	164	216	118	88	26
SiO_2	35.10	40.00	45.42	55.39	.....
Fe_2O_3	30.24	26.98	30.02	26.97	.....
FeO	17.29	14.94	11.93	6.84	.....
Fe	34.70	30.486	30.274	24.78	.....

When crushed to one hundred mesh the same material gave the following results:

	(12)	(13)	loss
Weight, grams	42.1	18.2	1.9
SiO_2	32.53	63.14	.....
Fe_2O_3	42.10	14.91	.....
Fe O	17.76	4.68	.....
Fe	43.27	14.23	.....

Sample No. 2 (393 R) when crushed to one-quarter inch gave the following results:

	(5)	(6)	(7)	loss
Amp.	.03	.05	.....	.....
Weight, grams	323	95	125	22
SiO_2	41.28	50.60	66.12	.....
Fe_2O_3	37.01	32.04	19.88	.....
Fe O	14.28	11.39	6.23	.....
Fe	37.01	28.27	18.76	.....

When ground to 100-mesh the same material gave:

	(14)	(15)	loss
Weight, grams	44.5	22.2	1.
SiO_2	33.61	75.99	.....
Fe_2O_3	43.00	9.35	.....
Fe O	18.56	2.67	.....
Fe	44.5	9.30	.....

Sample No. 3 (333 R) when crushed to one-quarter inch:

	(8)	(9)	(10)	(11)	loss
Amp.	.03	.05	.07	tails	
Weight Grams.	121	194	240	430	236[1]
Corrected Weight	121	194	312	558	36
SiO_2	19.75	26.06	30.73	56.16	
Fe_2O_3	56.27	45.14	44.85	21.61	
Fe O	16.41	16.21	13.26	6.69	
Fe	52.14	44.20	41.72	20.33	

When ground to pass 100 mesh this sample gave:

	(16)	(17)	loss
Weight	24.3	51.5	2.3
SiO_2	15.71	49.86	
Fe_2O_3	51.71	25.92	
Fe O	25.00	5.49	
Fe	55.49	21.95	

Further sampling may yield material which will give better results, though sample No. 3 gives a concentrate which is merchantable both from the quarter-inch and the hundred mesh. Combining the results from the coarser material in analyses 8, 9 and 10, we get a concentrate running 44.5 per cent. Fe on 51.4 per cent. of the ore. Finer grinding of numbers 9 and 10 would undoubtedly raise the percentage and it is probable that screening the concentrates would materially improve the product. In order to get a high grade concentrate it will probably be necessary to grind the ore to two hundred mesh.

Economic Possibilties

In estimating the value of the Kaministkwia range, comparison must be made with the other large ore reserves, not only of the Lake Superior region, but of other parts of the world. The natural ore, while low grade, may become when beneficiated, an important factor in the future development of the iron industry of Ontario. Under present conditions it is doubtful whether the crude ore would find a market under any conditions and without extremely fine grinding it would be impossible to obtain a concentrate that would run better than 50 per cent. iron. In one case drilling operations have been carried on but the record of this work was not available. It is unlikely that the surface outcrops of the iron formation will yield any high-grade ore. In no case did the writer estimate the iron content of an outcrop at more than 35 per cent. iron and the analyses show that in, at least, three cases which were looked upon as more favourable than the average, the estimate was slightly high. The estimate in the field was based upon the width of the jaspilyte and magnetite bands as outlined in the writer's report[2] on the Hunter Island deposits.

[1] A portion of the tails from .05 was lost. Assuming 36 grams to be dust which would be lost, the remaining 200 grams were distributed in the .07 and the tails.

[2] Ont. Bur. Mines, Vol. XXV, 1916, Pt. 1, p. 167.

Methods of Development

Two methods of developing these ores are possible: open quarry work on the low grade outcrop with subsequent concentration, or diamond drilling to ascertain whether there is a better grade of ore at depth. The first method will give a large tonnage, but it is doubtful whether, under present conditions, a high grade concentrate can be made at a profit. The second method offers little hope in view of the results of Robinson's survey. From a structural point of view there should be a deposit underlying the valley. Robinson's map, however, shows distinct breaks between the main deposits on the two sides of the syncline. For the final proving of the extent of the deposits it will be necessary to drill, and the writer is of the opinion that approximatingly flat lying iron formation will be found underneath the valley. Whether it will be of better grade than the outcrops is decidedly doubtful, but so far as can be seen, the only chance of finding high grade ore lies in drilling. Tunnels and test pits have been opened on most of the claims, so that the quality of the surface can be said to be proven. Results of analyses were given by one of the operators which, while slightly higher than the results obtained from the writer's samples, are in practical agreement.

Calculation of Iron Content

In estimating the percentage of iron in a deposit such as the one under consideration, use may be made of the determination of the specific gravity of the ore as a means of avoiding the expense of unnecessary analyses. In general it may be stated that an ore which has a specific gravity of less than 4.1 will be not marketable without concentration, and one whose specific gravity is less than 3.67 will not pay to concentrate. Pure magnetite and pure hematite each have a specific gravity of about 5, while 2.67 is the specific gravity of quartz. If we know the specific gravity of the ore (G), the percentage of iron present can be calculated with sufficient accuracy (within two per cent.) for preliminary work by means of of the following formula:

$$\frac{G-2.67}{5-2.67} \times 70 = \text{Percentage of iron.}$$

Boulder Clay

An interesting feature of the great terrace of the Kaministikwia valley is shown in a cut on the Canadian National railway about three quarters of a mile north of Crest, where there is a deposit of boulder clay (Fig. 1.) in which at least one distinct bedding plane is visible. That this was deposited by ice can hardly be doubted, but in view of the bedded character it is difficult to look upon it as ordinary moraine material. It is equally difficult to conceive of a five foot bed of this material forming as the result of a single freshet piling up ice laden with clay, sand and boulders, which is a second possible explanation. This boulder clay is underlain by loose gravel and overlain by a thin sandy deposit which is covered by clay soil, all of which are evidently deposited from water, so that the accumulation of this material by the piling up of blocks of ice laden with debris seems very probable. Deposits several inches in thickness have been observed by the writer in the process of formation in regions where the sediment was principally sand and clay, and in numerous instances boulder ridges have been observed in northern lakes which can hardly be explained, except by transportation by floating ice.

Steeprock Lake

A short time was spent on Steeprock Lake in an attempt to secure data in connection with the possible extension of the iron deposits under the lake. Little positive data could be obtained. It has been shown, however, that flat lying bodies of iron ore, even when strongly magnetic, exert no influence on the dip needle[1] so that in a region where iron ore is known to occur it is necessary before condemning a particular property to have not only an accurate magnetic map, but a detailed geological map showing not only the surface outcrops, but the structural geology as well.

Fig. 1.—Bedded boulder clay near Crest, Ont.

Silver

During the time the writer was in the field, interest in silver mining was concentrated on the Silver Islet mine near Thunder cape, and the Federal mine in Paipoonge township. In addition to visiting these two mines the writer visited many of the mines to the west of Port Arthur, known as the Silver Mountain area, as well as some of the old zinc-lead mines in Thunder Bay district. These latter were visited, as it was found that in every case the silver mines of this district carried zinc blende and galena, and it was thought that the silver-bearing veins were of the same origin and age as the lead-zinc veins.

A comparative list of minerals from this district and the Cobalt area was given by N. L. Bowen[2], which shows a wonderful similarity in the two areas. This, however, is only partially complete, as the following tabulation of the minerals seen at various mines will indicate.

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[1]Broderick, T. M., Econ. Geol., Vol. 13, No. 1, pp 35-49, 1918.
[2]Ont. Bur. Mines, Vol. XX, 1911, Pt. I, p. 128.

MINERALS OBSERVED AT SILVER MINES AND PROSPECTS.

MINERAL	Silver Islet	W. End Silver Mtn.	Gopher mine	E. End Silver Mtn.	Badger	Porcupine	Amorthite shaft	Edward Isld.	Dorion (lead & zinc)	Bishops mine	Blende Lake	Beaver	Federal
Silver	x	x				x							
Mercury	x												
Graphite	x												
Niccolite	x												
Smaltite or Chloanthite	x												
Argentite	x	x				x							x
Galena	x		x			x	x	x	x		x	x	x
Sphalerite	x	x	x	x	x	x	x	x	x		x	x	x
Pyrite		x			x	x	?		x				
Marcasite	x						x					x	x
Pyrrhotite													
Chalcopyrite													
Bornite													
Proustite													
Animikite	x												
Macfarlanite	x												
Calcite	x	x	x	x	x	x	x	x	x	x	x	x	x
Fluorite	x	x		x	x	x						x	x
Dolomite	x				x		x						
Quartz	x	x	x	x	x	x	x	x	x	x	x	x	x
Barite													
Siderite				x	x		?						
Annabergite	x												
Malachite									x	x			

In using this list for comparative purposes it must be borne in mind that in most cases the mines were closed down and full of water or ice, so that the material to be used in making a judgment had to be secured from the dump. This readily explains the lack of silver and argentite in the list for many of the mines. In general it may be said that the veins of this district consist principally of calcite, quartz (in part amethystine), fluorite, galena, sphalerite, marcasite, argentite and silver. In the case of the Silver Islet mine to the above must be added niccolite, smaltite or chloanthite, mercury (probably in the form of arquerite), annabergite and dolomite with possibly huntelite. The nature of animikite and macfarlanite is discussed elsewhere in this report.

The admirable descriptions of the mines of this district given by Ingall[1] and Bowen[2] make further description of those that are not working, undesirable. The only point that could be added is that nature is gradually restoring the landscape to the condition that existed before the mines were opened. It is only when new work is done that further information of value can be obtained.

[1]G. S. C. Ann. Rep. 1886, Pt. H.

[2]Ont. Bur. Min., Vol. XX, 1911, Pt. 1, pp. 119-132.

Origin of the Silver Ores.

So far as work has shown, the silver bearing veins are located in the Animikie slates and post-Animikie diabase sills, flows and dikes. The mineral content of the veins, however, is not all such as is commonly supposed to be due to basic igneous rocks, though a part of the minerals are usually found in veins in such rocks. The experience at Cobalt has shown that the nickel-cobalt minerals are almost invariably in the diabase, as well as in the sedimentary rocks, and while silver is found in the granite, it is by no means so common as in the diabase. The peculiar feature of the Thunder Bay silver veins that seems to point to another source for part of the vein material is the universal presence of fluorite which is more com-

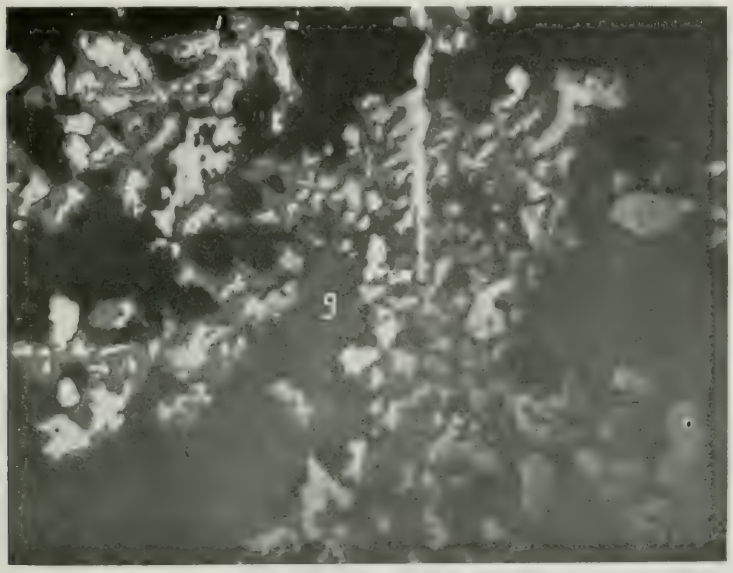


Fig. 2.—Macfarlanite—(s m)) Smaltite, (g) galena (white mineral) silver.

monly supposed to be connected with the emanations from an acid magma such as granite, though found also with phonolyte and andesite. In the case of the Dorion lead and zinc mines it is difficult to assume any other origin, as these veins are near the granite contact, and little if any basic rock is present. In the other mines visited the case is not so clear as granite exposures are not near at hand. In discussing a similar series of ores in the Ainsworth mining camp in British Columbia, Schofield[1] attributes the origin to solutions emanating from granite in the pneumatolitic stage of cooling on the ground that fluorite is a common gangue mineral.

[1] Geol. Surv. Can., Mem. 117, p. 36.

Silver Islet Mine

This mine, which was operated from 1869 to 1884 and produced approximately 3,000,000 ounces of silver, was partially pumped out during the summer of 1920 by R. C. Jamison and D. C. Peacock, Duluth, Minn., for the purpose of sampling the roof and first level. It was popularly supposed that the roof was broken so that it would be impossible to unwater the mine, but the first day's pumping showed this to be incorrect as the water was lowered 45 feet in the shaft. The entire work of pumping was done with compressed air and the first level was kept free from water until the sampling was completed. A mill and smelter sample was taken from the roof, and as autumn approached the machinery was removed to the main land for the winter. During the winter diamond-drilling has been in progress, and it is hoped that the results of this work will supplement the favourable results secured in the roof of the mine. In January, 1921, the Islet Exploration Company, Limited, of which Mr. Peacock is the manager, was incorporated under the laws of Ontario.

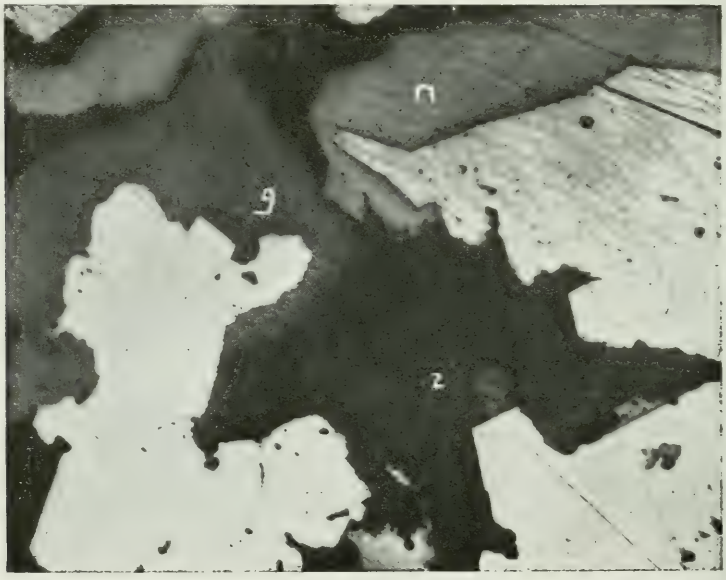


Fig. 3.—Macfarlanite—(n) niccolite, (g) galena, (z) zinc blende, (white mineral) silver.

The ore showing in the roof of the mine is largely macfarlanite with native silver, argentite, galena and sphalerite. In order to ascertain the nature of the macfarlanite numerous samples were taken and through the kindness of Ellis Thomson, of the University of Toronto, a mineralographic study has been made which shows conclusively that this material is an intimate mixture of silver, niccolite, smaltite-chloanthite, galena, and sphalerite, which is the typical association in the Cobalt area. The order of deposition as shown in the illustrations (Figs. 2 and 3) is apparently galena and sphalerite, probably crystallizing contemporaneously, followed by silver which is frequently completely inclosed by niccolite.

Inasmuch as the early analysis by Macfarlane[1] showed the only constituents to be silver, mercury, nickel, antimony and arsenic, and recalculation of the analysis showed that the arsenic and antimony were present in the proper propor-

[1]Trans. A. I. M. E. Vol. 8, p. 238.

tion to form niccolite and breithauptite, it was deemed advisable to have an analysis made to settle definitely the much-mooted question of a compound of silver with arsenic or antimony is the material. In preparing the specimen it was impossible to get absolutely pure material but from the mineralographic study it was definitely known that the material contained silver, niccolite, smaltite, galena, sphalerite and dolomite. After picking out as much dolomite as possible the sample was crushed in an agate mortar, and screened on a sixty-mesh sieve. The oversize and fines were analyzed separately by E. W. Todd, in the Mineralogical Laboratory of the University of Toronto, and the results combined in proportions to the weights of the two portions, to give the average composition of the ore. The results follow:

Composition of Macfarlanite.

Schedule	Oversize		Fines		Average	
	percentage	molecular proportion	percentage	molecular proportion	percentage	molecular proportion
Ag	79.91	.731	12.44	.115	32.54	.302
Pb	2.01	.010	20.31	.098	14.86	.072
Zn	0.26	.004	0.94	.014	0.59	.009
S	1.22	.038	4.42	.141	3.46	.108
As	5.40	.072	12.27	.164	10.23	.135
Sb	0.48	.004	0.72	.006	0.65	.054
Hg	0.84	.004	0.21	.001	0.39	.002
Ni	4.29	.073	9.42	.161	7.92	.135
Co	0.31	.005	0.82	.014	0.66	.011
Fe	0.20	.004	0.44	.008	0.37	.007
Ca O	1.18	.021	14.15	.251	10.29	.181
Mg O	0.64	.016	6.55	.163	4.80	.119
CO_2	1.40	.032	17.78	.414	12.55	.285
Total	98.14		100.47		99.30	

In making the analysis it was necessary to make the determinations of zinc, sulphur, lime and magnesia, and carbon dioxide on separate portions, so that the recalculation of the analysis which follows shows a few minor variations from the results that would be demanded by theory. In the scales the following minerals were recalculated.

Mineral	Molecular proportions						Percentage
Dolomite	Ca O	.016	Mg O	.016	CO_2	.032	2.94
excess of	Ca O	.005					(0.28)
Marcasite	Fe	.004	S	.008			0.45
Galena	Pb	.010	S	.010			2.33
Sphalerite	Zn	.004	S	.004			0.39
Breithauptite	Ni	.004	S C	.004			.71
Niccolite	Ni	.069	As	.069			9.20
Cobaltite	Co	.005	As	.003	S	.007	0.78
Argentite	Ag	.018	S	.009			2.26
Silver	Ag	.713					77.94
Mercury	Hg	.004					0.84

It will be noted that there is a slight excess of lime above the carbon dioxide ratio which is readily accounted for because these were determined on different portions. In calculating cobaltite, sulphur is here assumed to replace arsenic. The mercury is undoubtedly amalgamated with the silver forming arquerite, which adds to the resemblance of this material to the cobalt silver ores which frequently yield as much as four per cent. of mercury from the silver.

The fine material yielded the same materials with the exception of argentite which was absent and calcite which is probably indicated by the excess of lime in the first analysis.

Mineral	Molecular proportions						Percentage
Dolomite	Ca O	.163	Mg O	.163	CO_2	.326	30.54
Calcite	Ca O	.088	CO_2	.088			7.94
Marcasite	Fe	.008	S	.016			0.94
Galena	Pb	.098	S	.098			23.38
Sphalerite	Zn	.014	S	.014			1.38
Breithauptite	Ni	.006	Sb	.006			1.07
Niccolite	Ni	.155	As	.155			20.66
Cobaltite	Co	.014	As	.009	S	.013	1.92
Silver	Ag	.115					12.44
Mercury	Hg	.001					0.21

It will be noted that in both these analyses when the nickel and cobalt have combined with the requisite amount of arsenic and antimony there is no excess of these latter to combine with the silver. In fact, there is a slight deficiency in arsenic in both analyses which is in direct proportion to the cobalt content. If we assume the presence of a very small amount of temiskamite in place of part of the niccolite, this discrepancy would disappear but this mineral was not recognized in the mineralographic examination.

From this examination it is definitely shown that in the Silver Islet mine the material that has been known as macfarlanite is a mixture of the minerals that are characteristic of the Cobalt area, and that these were deposited later than the argentite, galena and sphalerite which are characteristic of the other mines in the Port Arthur region. It is also of considerable interest and probably of economic importance to note that this association is found in the dolomite and not in a vein which is principally calcite.

In connection with the examination of macfarlanite a sample of animikite which was obtained from the dump was examined by Mr. Thomson who found that it consisted of the same minerals as the macfarlanite. The sample was not large enough to furnish material for an analysis, but in view of the confirmation by the analyses of Mr. Thomson's findings in the case of macfarlanite there appears to be no reason to make an analysis. This material must also be considered a mixture. No specimen of huntelite, the third material which has been looked upon as peculiar to this mine, was obtained.

In order to show the nature and size of the Silver Islet vein, photographs of the roof of the stope were taken. The width shown in Figure 4 is from ten to twelve feet. The light coloured vein material consists principally of dolomite which is decidedly rich in macfarlanite, sphalerite and galena. The brecciated character of the vein is well shown, but the apparent tapering of the veins is due in large part to the fact that the roof is sloping so that the lower part of the picture is much farther from the camera than the upper part. Figure 5 shows a closer view of another portion of the vein and illustrates the remarkable brecciation that is shown throughout the upper level. The greatest width of vein material that was mined was about twenty-four feet and was at the junction of the two main veins on the first level.

An interesting feature of the mining operations at Silver Islet is the plan that evidently has been adopted to recover the ore from the roof. Inasmuch as it is estimated that several hundred thousand ounces of silver remain in the roof, the re-

Fig. 4—Roof of stope showing Silver Islet vein.

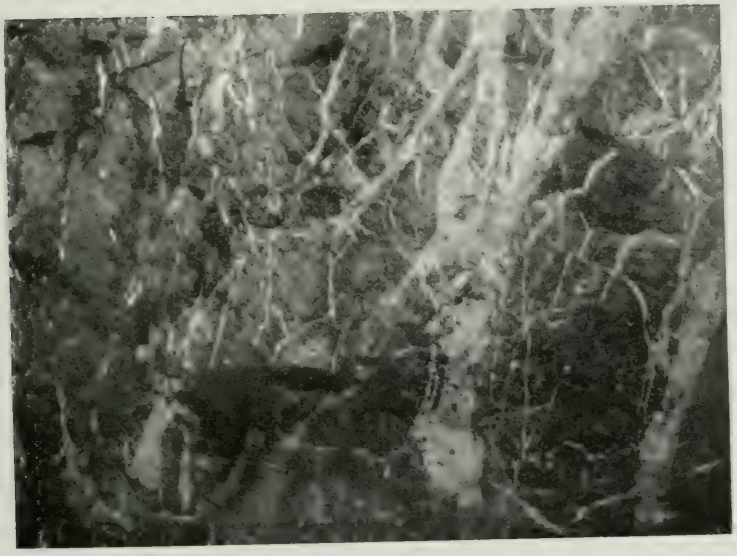


Fig. 5—Closer view of Silver Islet vein, showing brecciation.

covery of this is an important item. To do this without drowning out the mine was a problem. Just below the roof a ledge about three feet wide has been cut in the wall so as to give a good passage-way practically the entire length of the workings. It was evidently the intention to roof this over with concrete after which the roof was to be blasted and the loose rock then dredged from above. It is certain that no other method would provide for the recovery of the roof and further working of the mine. The unexpected closing down of the mine, however, left this work for a later development.

Federal Mine

A shaft about forty feet deep has been sunk at the Federal mine in Paipoonge township on a strong vein which is about five feet wide. The vein material is principally quartz and calcite, but with these there are fluorite, barite, marcasite, galena, sphalerite, argentite and silver. Most of the silver value is present in the form of argentite, and it was reported by F. S. Wiley, who is developing the property, that the average value obtained in sinking is about thirteen ounces of silver. The association is the same as that exhibited by the other West End mines, and so far the values have been found in crossing the Animikie slate.

Calcite

In all the veins of the region, calcite is found in abundance and when crystals are found in vugs, the form varies in a remarkable degree. When several minerals are crystallizing from a solution it has been found that they frequently exert a decided influence on the forms that will appear on the various substances, so that in certain cases it is possible to indicate the conditions which prevailed at the time when a substance crystallized by the forms present on the crystal.

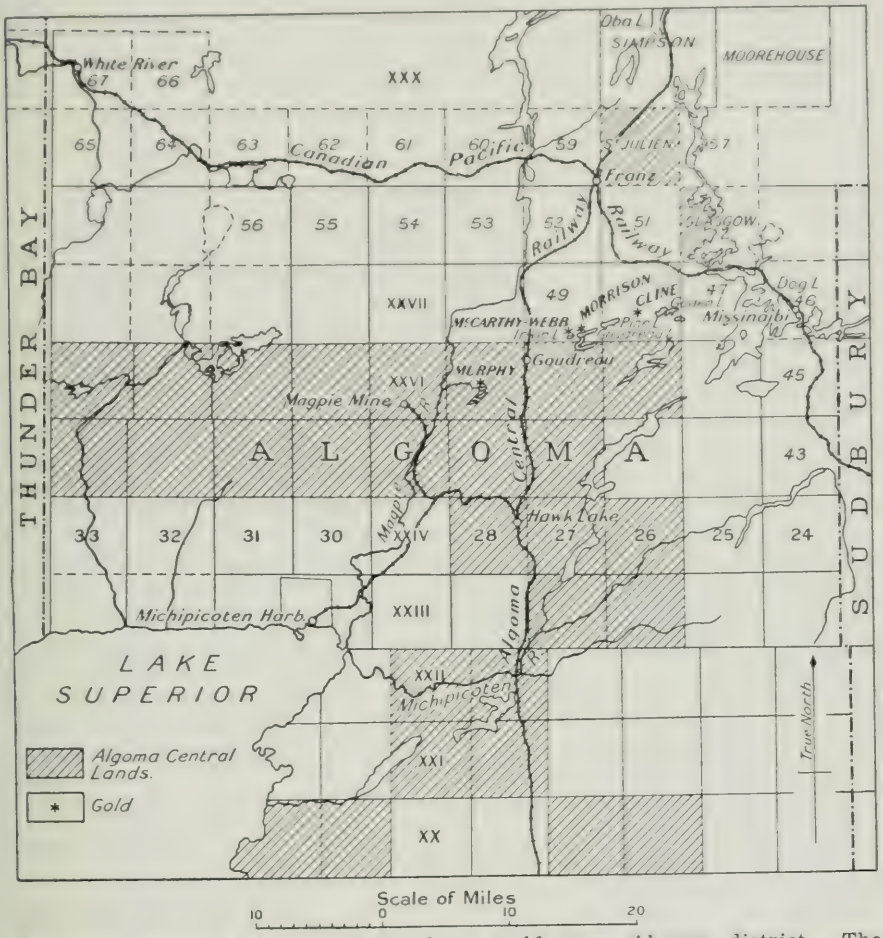
A vein in which calcite of two ages occurs was found on the north side of the Shangoinaw island about a mile west of Silver islet. So far as observed, no other mineral was present, so that the conditions appear to be the simplest possible. The older generation of calcite has been partially dissolved, presumably by rain water, so as to present a tabular aspect. Upon these crystals a new growth started giving crystals that are nearly colourless and free from cleavage cracks so that in some cases the calcite is probably fit for optical use. The surface is somewhat frosted so that the remarkable clearness is seen only when a crystal is split. These crystals show the unit rhombohedron as the dominant form but in addition show the base as well as several other forms which are principally scalenohedrons. Some of these forms are new for this mineral, and it is thought that the combination shown here represents the material that crystallizes from water containing carbon dioxide (rain water) at the temperature of Lake Superior water in the summer months, at a pressure not to exceed two atmospheres.

The study of the crystal form of this calcite, while yielding no immediate economic results has a bearing on the deposition of ores and further work may yield information of considerable value. In preparing crystals of various substances in the laboratory it has been shown that the same substance will develop entirely different combinations of crystal faces, depending upon the nature of the solution from which the crystals are formed and the pressure. The difficulty in the case of mineral deposits is to ascertain the nature of the solution from which a particular mineral crystallizes. It has been shown by experience that the habit of crystals of a given mineral in a given mineral association is fairly uniform, so that a mineral like calcite which is almost universal as a vein mineral, might well serve as an index to the particular stage of ore deposition that had been reached in a particular vein or portion of a vein.

NOTES ON THE GOUDREAU GOLD AREA

By A. G. Burrows

In accordance with my instructions of 22nd June, 1921, I proceeded to Goudreau station on the Algoma Central railway, to examine the recent gold find on the Murphy claims which are located in township 28, range XXVI, district of Algoma. This township is included in the land grant of the Algoma Central Railway Company, and claims staked in it are recorded at that company's office at Sault Ste. Marie.



Key map showing location of Goudreau gold area, Algoma district. The Murphy claims are located in Township 28, Range XXVI.

Means of Access

The area is most conveniently reached from Franz, a station at the crossing of the Canadian Pacific and Algoma Central railways. Goudreau, the nearest railway station to the gold discovery, is 17 miles southward from Franz; the Murphy claims are about 3½ miles southwestward from Goudreau. The camp is reached by a good canoe route starting one-half mile south of the station.

The route, which requires about two hours' travelling, is by way of Jackson, Long, Doherty, Aitken and Murphy lakes. The longest portage is about one mile. The find is located near the north shore of Murphy lake on mining claims 407 and 408.

Discovery

The discovery was made by Thos. Murphy of Goudreau while engaged in fur trapping in the month of April 1921. A. V. J. Selkirk, of Franz, merchant, and Jas. Perry, Goudreau, were early partners with Mr. Murphy; later, several others were given interests in the claims. Twelve claims in the vicinity of Murphy lake were staked by these gentlemen. At the time of my visit the claims were being examined by C. G. Daimpré for A. R. Porter of Toronto. Mr. Porter was on the ground, and before leaving procured an option on that part of the property on which the gold-bearing veins are located.

Geology

The rocks in the area to the southwest of Goudreau are dominantly basic volcanics of Keewatin age. Rocks of this character were observed from Goudreau all along the portage route to Murphy lake. The ellipsoidal structure, with amygdules so characteristic of much of the Keewatin, is frequently seen. In places the basic lava contains considerable carbonate, and is lighter-coloured than the normal dark-coloured rock. Most of the lavas are altered to schist, which has a general strike nearly east and west. With the lavas there is a small amount of banded iron formation, magnetite and silica, seen on claims 408 and 412. In the vicinity of Goudreau the main iron formation zone is prominent. Two of the large iron pyrites properties, the Goudreau mine of the Nichols Chemical Company, and the Rand Consolidated Mines, are near Goudreau; neither of these being in operation at the time of inspection.

With the basic volcanics in the vicinity of Murphy lake there are several intrusions of quartz porphyry or quartz-feldspar porphyry; these acid rocks are generally schistose like the darker lavas. Some of the quartz-porphyry occurs as dikes cross-cutting the strike of the lava flows. One small mass of porphyry intrusive into the basic rock can be observed on the north line of claim 407.

A mass of grey granite, gneissic in places, occurs on several claims to the west of the gold discovery.

Several narrow dikes of the diabase with a N.-S. strike cut the older formations. One of these along the east line of claim 459, is an olivine diabase. The rock relationships are illustrated in the accompanying geological sketch map.

Veins

Gold was first discovered in a quartz vein in the southeastly part of claim 408 (Murphy), where for a distance of about 20 feet along the hanging-wall side of the vein, there are a number of showings of quite coarse gold in the quartz. The quartz vein has been traced by trenching, and outcrops for about 800 feet on claim 408. It strikes approximately N 70° W, and the dip, where observable, is from 60° to 80° S. It varies in width from seven inches to three feet. Along the quartz vein the wall rock has been altered in places to a rusty schist containing ankerite and sericite, and carrying quartz veinlets together with sulphides at different points. The width of the altered rock appears to vary greatly, but owing to the small amount of cross-trenching, the width of the possible mineralized wall

rock could not be determined. The hanging-wall contact of the quartz and schist is more definite than the footwall. At the location of the gold showings the vein, including the wall rock, is about 3 feet in width, while 15 feet to the north is a subsidiary quartz vein a foot in width, to the north of which is a band of ankerite. Twenty feet to the west this smaller vein is only 3 feet from the main vein. The quartz vein in places is well mineralized with pyrites, copper pyrites and pyrrhotite; 150 feet southeasterly from the above showing, the quartz vein is about 7 inches in width, and in a band of sugary quartz and schist on the hanging-wall, visible gold was seen.

Work has also been done on claim 407 to the east. At the west line, 200 feet north of Murphy lake, a narrow quartz vein about a foot in width has been traced 65 feet; it strikes S 80° E. The wall rock for a few inches is quite rusty, and

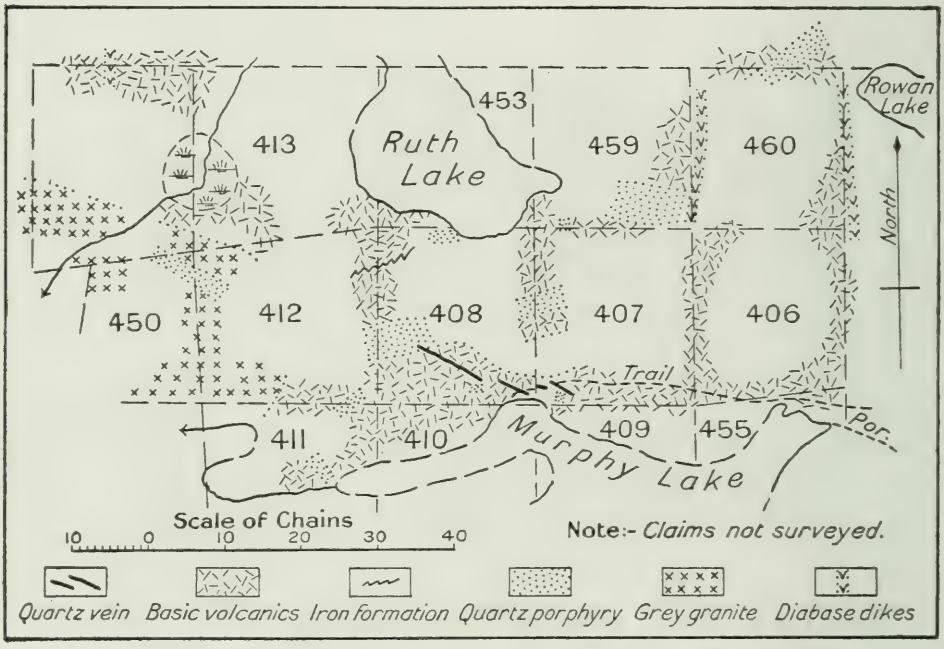
Gold bearing quartz vein, Murphy claim (Goudreau Gold Mines), showing hanging wall contact with Keewatin rock. White quartz is about two feet wide in foreground, while the foot-wall is silicified rock. Visible gold occurs in the outcrop.

carries sulphides. Visible gold was observed at two points along the vein. About 200 feet easterly from the west line work has been done on a wide ankerite-schist band up to 20 feet in width, which carries quartz veins roughly parallel to the ankerite band. It has been traced for 170 feet in a direction S 70° E. No visible gold was observed in this vein, but at one point an assay of $6.00 in gold was obtained over a width of 2ft. 9 in. of quartz, and $4.00 in gold over a width of 5 ft. 6 in. of the schist and carbonate, carrying quartz, lying to the north. Owing to the highly altered character of the schist by oxidation, the latter assay is only indicative of the presence of gold, and may represent concentration. The quartz vein carries pyrite, copper pyrites, pyrrhotite, and a little zinc blende. It is possible that this easterly vein is the faulted part of the vein exposed on claim 408.

A geological sketch map showing the approximate location of the veins on claims 407 and 408 accompanies these notes. A number of assays of samples obtained at points along the veins showed gold values ranging from a few cents to $28.00 per ton. None of the assays were taken from points where visible gold

was seen. In addition, two essays were made of specimens of quartz carrying a high percentage of sulphides, from a pit a few feet west of the rich gold showings, which gave $31.20 and $48.80 in gold.

The property, however, was not in condition for any thorough sampling, since few cross trenches had been made exposing the walls of the vein, and none below the superficial oxidation. The main vein shows high grade ore for at least 40 feet near the discovery, but extensive work will be required to determine the possible ore shoots, since large portions of the vein are concealed by drift. Cross trenches and blasting to the unoxidized vein, preparatory to sampling, will be carried on, and it is expected that a shaft will be sunk on or near the rich section of the main vein.



Geological sketch map showing veins on claims 407 and 408.

From later information it appears that trenching about 500 feet westerly from the original discovery exposed the vein showing visible gold in greater abundance than in the shoot farther east. Two shafts have been sunk to moderate depths, namely, 40 feet and 43 feet, and a third to a depth of 6 feet. On the installation of hydro-electric power, mining operations will be resumed.

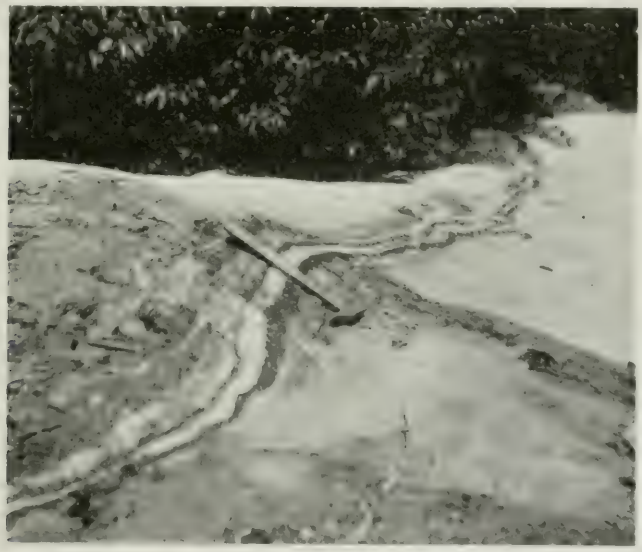
The property was taken over by C. A. Foster in the fall of 1921, and a company known as the Goudreau Gold Mines has been organized. A mining plant including a 10-drill compressor has been installed on the property. The nearest available hydro-electric power is at Magpie mine, from which point a transmission line has been constructed to the Goudreau Gold Mines.

Townships 48 and 49

A short trip under the guidance of Jas. Cline, a prospector, was made northeastward from Goudreau in townships 49 and 48, range 27. Gold has been dis-

covered on a number of claims between Goudreau station and Goden lake, which lies in the southeast part of township 48.

McCarthy-Webb.—The McCarthy-Webb group of claims 2049, 2050, etc. near Iron lake, has been described by W. H. Collins[1] in his report on the Magpie-Hawk area. Briefly, the rock is a schistose porphyry which, in places, is a quartz-porphyry with a strike N 84° E mag. Shear zones occur in the porphyry, and these are indicated by a rusty surface containing vague quartz veinlets, which is in marked contrast to the white porphyry. The rusty streaks are very irregular in length and breadth, being from a few inches to a few feet in width, containing fine-grained iron pyrites. Gold in a very fine state has been found in the rusty zones. In addition, there are widely separated transverse veinlets of quartz carrying much tourmaline, in which coarse gold has been discovered. These veins are more definite than those running with the schist. The property has been sampled several times, particularly in one place for a length of 100 feet, where the rusty condition is most pronounced.



Transverse gold bearing quartz vein carrying massive tourmaline, Morrison claim 2025, north of Goudreau lake. The dark rock in the foreground is schistose basalt. The lighter rock in the background is schistose quartz porphyry.

Morrison.—The Morrison claim, 2075, on the north shore of Goudreau lake, is similar to the McCarthy in structure. However, the rusty zones running with the schist are less pronounced, while there are more of the transverse quartz-tourmaline veins. Visible gold has been found in a number of the narrow veins which are parallel to the schist, and also in the transverse veins. The main shears, about a foot in width, strike from N 66° to N 86° E, whereas the cross veinlets strike N 6° E. The latter vary from a fraction of one inch to 14 inches in width, and are too widely spaced to mine together.

[1] Geol. Sur. Canada, Summary Report, Pt. E., 1918.

Cline.—A number of claims about 1½ miles northeast of Pine lake were also visited. Visible gold was seen on claims 2186 and 2189. The rocks are Keewatin schist in which narrow quartz veins have been formed. A shaft was sunk 25 feet on claim 2189, on a quartz vein from 1½ inches to six inches in width, in which there is a high percentage of sulphides, also visible gold. The extension of the vein to the west where it is cut by a diabase dike, has not been found.

On claim 2186 there is one narrow rich quartz vein about 5 inches wide, in which gold has been found over a length of 20 feet. A second vein from 8 inches to 3 feet wide occurs on the claim. It consists of quartz and schist, on which a 5-foot pit has been sunk. Material from this vein showed much gold in panning. Owing to the heavy drift covering, it is difficult to trace the veins any distance.

Some rusty shear zones were also observed on claims 2183 and 2184. On claim 2184 in one trench the rusty zone is 15 feet in width, which diminishes rapidly to the west. Some visible gold is reported near the north wall. Sufficient work has not been done on any of these claims to determine their value.

Literature

The geological reports on the Michipicoten area for the greater part refer to the iron ranges. These reports include those by W. H. Collins[1], J. M. Bell[2], A. P. Coleman[3], and A. L. Parsons[4]. W. H. Collins, in his report refers to the gold area to the northeast of Goudreau. His geological map of the Goudreau Pyrite Area extends westward to within a mile and a quarter of the Murphy claims.

At the time these notes were made Ellis Thomson was in the field for the Geological Survey, continuing the mapping of the area begun by W. H. Collins. His work will include an examination of the area southwest of Goudreau in which the Murphy claims are located, and the area near Pine lake.

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[1] The ore deposits of Goudreau and Magpie-Hawk Areas, Michipicoten, Ont., Geol. Sur. Canada, 1918, Part E.

[2] Iron Ranges of Michipicoten West, 14th report, Ont. Bur. Mines, 1905, Part I.

[3] Michipicoten Iron Region, Coleman and Willmott, 11th report, Ont. Bur. Mines, 1902.

[4] The productive area of the Michipicoten Iron Ranges, 24th report, Ont. Bur. Mines, 1914, Part I.

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THIRTIETH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

VOL. XXX, PART V,

1921

I—Natural Gas in 1920

II—Oil Field Operations, 1920

By

E. S. ESTLIN, COMMISSIONER OF NATURAL GAS

PRINTED BY ORDER OF THE LEGISLATIVE ASSEMBLY OF ONTARIO

TORONTO

Printed and Published by CLARKSON W. JAMES, Printer to the King's Most Excellent Majesty

1922

Printed by
THE RYERSON PRESS

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NATURAL GAS IN 1920

By E. S. Estlin, Commissioner of Natural Gas

Work of the Year

Certain amendments to the Natural Gas Act 1919 were submitted to the Legislature in the session of 1920 but were eventually withdrawn, consequently the Act remained unchanged except as regards a slight amendment giving the Natural Gas Commissioner authority to administer an oath and take an affidavit, statutory declaration or evidence under oath in any part of Ontario.[1]

During the months of February and March, the Commissioner was occupied chiefly in holding inquiry into the general situation at some of the important centres in the natural gas area, a full account of which has been published in the Twenty-ninth Annual Report of the Ontario Department of Mines, 1920, Part V. The evidence submitted at these inquiries was transcribed from the stenographer's notes and bound in a separate volume covering the Inquiry held at each of the following places: Sarnia, Windsor, Chatham, Hamilton and Woodstock. These volumes are on file in the Department of Mines, at Toronto.

Many matters pertaining to the Natural Gas Industry, which come within the Commissioner's jurisdiction, have been dealt with during the course of the year; these will be treated briefly in this report under separate headings.

In dealing with matters under complaint, making adjustments and regulating the gas service and supply generally, official enquiries were held and evidence heard respecting conditions at the following places:—

Aldborough	Fonthill	Simcoe
Barton Tp.	Galt	Southwold Tp.
Belmont	Hagersville	St. Catherines
Brantford	Hamilton	Stevensville
Bridgeburg	Ingersoll	Vienna
Canfield	London	Wallaceburg
Chatham	Moulton Tp.	Wellandport
Dorchester	Oil Springs	Welland
Dunnville	Paris	West Lorne
Dunwich Tp.	Port Burwell	Windsor
Dutton	Rodney	Woodstock
Fingal.	Sarnia	

Complaints reach the Commissioner's office from time to time regarding damage done by unplugged wells. Some such complaints were made the subject of special investigation by the Inspectors during the year. This is a task that required much experience, because it is most difficult to determine just where the trouble lies. When a case of this kind is put in the hands of the Inspector, it is carefully watched until the remedy has been determined upon and applied.

In reviewing the events throughout the year, it may be said that 1920 has been a year of special interest to those who have taken an active part in the natural gas problems of Ontario.

[1] An Act to Amend the Natural Gas Act, 1919.

The Relief Natural Gas Company withdrew from active operations altogether, and as part of their main supply line was owned by other interests, the pipe was taken up and disposed of. In this way, the connection between the wells and the villages of Fonthill and Ridgeville and township of Pelham was cut off, leaving these districts without any gas supply. This matter was met by the Commissioner's office obtaining a junction with the adjacent high pressure line belonging to the United Gas Companies, and gas was purchased from this Company and distributed through the remaining distributing system of the Relief Company, by the courtesy of A. H. Trappnell, the liquidator.

The National Gas Company, Limited, sought permission to remove and dispose of their twenty-one mile pipe-line consisting of 8, 10 and12-inch pipes laid between the Seneca gas field and the city of Hamilton.

This company had formerly delivered the output of its wells to the Dominion Natural Gas Company for distribution in Hamilton, who conveyed the gas through its own lines, hence the expense of maintaining this valuable line by the National Company was considered unnecessary.

The Southern Ontario Gas Company constructed a pipe-line in Kent County at a cost reported to exceed $100,000 to tap the wells of the independent producers in Dover township. This makes a fairly direct connection between the Company's main pipe-lines at the field end in Tilbury township.

The formation of the Municipal Gas Consumers' Association was one of the events of the year. This organization grew out of the negotiations that were being carried on between the Natural Gas interests and the municipalities regarding the matter of rates, and is composed of representatives of certain municipalities having franchises with the Gas Companies: the present secretary is H. H. Hallatt, Tilbury.

The effort to obtain increased rates put forth by the natural gas interests, with a view to preserving and maintaining the industry, was successful in many localities, and a slight upward trend of prices was observed. But in Essex, Kent and Lambton counties, the increase took the form of a temporary rate of forty cents the Gas company agreeing to deposit the difference between that price and the franchise rate with the treasurer of the municipality, to be subsequently disposed of when a scale of permanent rates could be reached.

Near the end of the summer the rate controversy reached such a pitch that the gas company discontinued the supply to the towns of Essex, Tilbury, Blenheim, Dresden and Ridgetown, this action being in violation of a special order previously served on all gas companies. The situation was met by the appointment of special agents of the Commissioner at each town, who proceeded to restore the service.

An important organization was formed towards the end of the year called the Union Development Company, Limited. This company is carrying on drilling operations in Dawn township and has two rigs now at work equipped for deep drilling.

Orders issued by Commissioner

The following orders were issued by the Commissioner during the year:—

Order No 6: Dated January, 31st, 1920, restraining the Chatham, Wallaceburg and Lake Erie Railway Co. from using natural gas in a steam power boiler.

Orders No 7 & 9: Dated January 7th and June 9th, 1920, respectively, in respect of the turning into the lines of the Union Natural Gas Company of the gas pro-

duction from the Petrol Natural Gas Company's well in Dover township.

Orders Nos. 8A, 8B, 8C, 8D.: Dated January, 10th, 1920, respecting the continuing of gas supply to the town of Aylmer.

Order No. 10: Dated July 30th, 1920, restricting the use of gas throughout the district served by the Provincial Natural Gas Co., Ltd., to cooking and heating of tap water only.

Order No 11: Issued September, 1st, 1920, in respect of the use of natural gas for industrial purposes without permit.

Order No 12: Issued September 1st, 1920, respecting the limiting of the use of gas obtained from the wells of the Provincial Natural Gas Co., Ltd.

Order No. 13: Issued October 25th, 1920, requiring the continuation of gas service in all localities by all Natural Gas companies.

Order No. 14: Issued December 20th, 1920, cancelling Order No. 9.

Order No. 15: Issued December 28th, 1920, forbidding the use of natural gas from the wells of the Union Natural Gas Company for heating purposes in public buildings.

Order No. 16: Issued December 28th, 1920, restraining the use of natural gas for heating purposes in Tillsonburg, Vienna, Aylmer, Port Burwell, Straffordville, Bayham Township.

Order No. 17: Issued December 29th, 1920, restraining the use of natural gas for heating purposes, and otherwise controlling the service in the town of Oil Springs.

Protecting the remaining Natural Gas Supply

It is intended to show under this heading the efforts that have been made by the Department in co-operation with the several gas companies for prolonging and conserving the gas flow in the various districts.

Deliberate and sustained effort to carry on development work in the form of new drilling was not undertaken to any great extent during the year. The reason given for this inactivity was that labor and price of equipment having reached a high level, the return from the sales of natural gas under the old rates, was inadequate: therefore, the producers turned their attention to protecting the resources of their present wells by devising and putting into practice many methods for checking waste and improving the service equipment.

"Unaccounted-For" Gas Supplied For Distribution

The practice of selling gas to a distributing company on a percentage basis figured on consumers' returns has a recognized disadvantage to the producing company, inasmuch as the latter carries the waste. A large proportion of the gas supplied from the Kent gas area is delivered under this arrangement.

Orifice meters, which measure gas volume under high pressures, have been brought to such a high standard of efficiency within the last few years, that it is now possible to determine comparative results of delivery and output, whereas in the past the output has only been checked from service meter returns.. Producing companies installed a number of these instruments throughout the year on their main lines, and the records are beginning to be of great value as a practical guide to certain necessary economies in the business.

These meters were placed at the junction of the producing company's main lines with the lines serving many cities and towns. The result has been that a comparison of the difference between the amount delivered into a town with the amount metered out to consumers was made possible, and corrective measures were adopted to check the difference thus brought to light. Table No. 1. gives some idea of the percentage of "unaccounted-for" gas occurring between delivery and consumption.

TABLE I.—PERCENTAGE OF LOST GAS UNDER DIFFERENT SELLING METHODS.

Case 1—
Where distributing companies purchase gas on a percentage basis, that is, the producer takes a percentage of the distributing company's receipts.

	Gas Supplied M. cu. ft.	Gas Sold M. cu. ft.	Gas Lost M. cu. ft.	Loss Percentage
A.	1,048,346	879,208	169,138	16.1
B.	191,373	157,129	34,244	17.9

Case 2.—
Where gas is supplied and distributed by one company.

A.	144,851	132,251	12,600	8.7
B.	187,662	170,609	17,053	9.1

Case 3.—
Where gas is bought and paid for by the distributing company at town border.

A.	156,989	153,475	3,514	2.2
B.	160,168	155,230	4,938	3.1

It will be noted from the above figures that there is an enormous difference in "lost and unaccounted-for" gas where the gas is purchased by the distributing company through town-border meters, as against the producer taking a percentage of the distributing companies' receipts. The figures quoted in Table No. 1. are the actual returns from measurements made during the year. Two instances are cited in each case to show the results under varying volume delivered.

Gas Losses in Syndicate or Private Lines

In carrying further this principle of measuring gas "wholesale," some attention has been given to instances where gas is delivered from high pressure lines into private or syndicate lines. These are cases where several rural consumers club together and lay a small line along a side road for the purpose of serving members of the syndicate. In some instances the producing companies have taken over the upkeep of these lines, and in others the line itself has been put in by the gas company under an annual rental paid by the consumers in addition to the current rate; but in most cases these lines are privately owned, and heretofore the gas has been turned in direct from the high pressure pipeline and regulated and metered at each dwelling.

The installation of meters at the high pressure end of syndicate lines is telling a tale of waste through leakage that calls for immediate remedial measures. Efforts are being made to correct the waste by apportioning the difference between the readings of the main line meter and the private meters, amongst the consumers and this will no doubt have the effect of reducing the amount of waste and improving upkeep of the lines. A conservative estimate of the total length of syndicate and private lines in the gas area is approximately 600 miles. These lines are usually of small diameter and require gas at high pressure to overcome the frictional resistance, so that the leakage is much greater than in the case of low

pressure mains. It is regrettable that statistics dealing with this phase of gas waste cannot be quoted here for the reason that the method of dealing with it as described, has been put in operation but recently, and figures are not obtainable.

Where gas is sold to consumers directly off the high pressure lines considerable waste has also occurred because of the practice of weighting the arm of the regulator which controls the pressure between the customer's meter and the high pressure line. These service lines are often too small rof thte purpose, and in many cases equipment in the residence is not in good condition. The consumer finds relief by placing a weight on the arm of the regulator and taking into the service line all the pressure the meter will stand. The result is that the relief valve on the regulator releases the surplus gas pressure and a very considerable waste results. If the relief vlve failed to function, the diaphragm of the meter would probably blow up under the increased pressure. Gas companies are meeting this difficulty by installing a safety device between the meter and the residence, (*see* diagram) which acts as a relief valve if excess pressure is put on, with this difference, that all gas so wasted is measured and paid for.

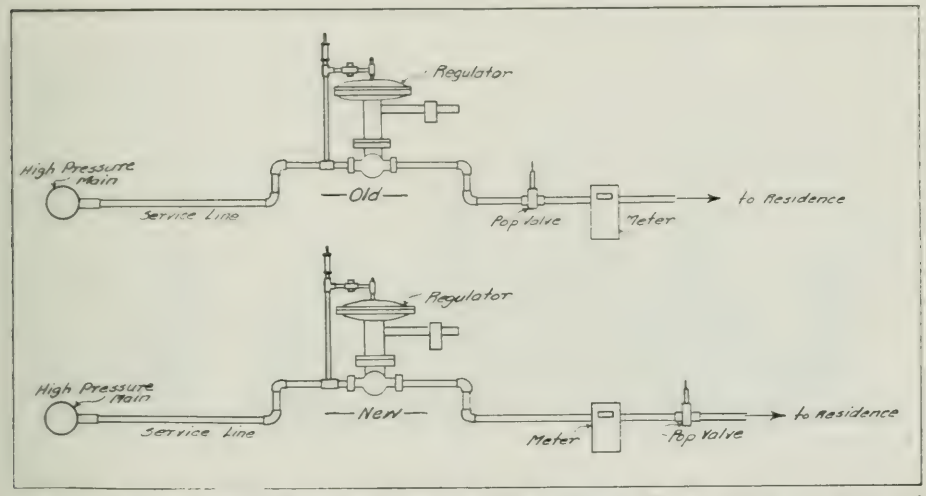

Diagram showing high pressure service with position of pop valve in both old and new style method of installation.

In connection with this particular form of waste, fifty regulators were examined, all weighted down, (a few of them having fence rails laid across the arm) and the pop-valves were all blowing gas into the atmosphere. This waste occurred before the gas reached the meter. In one case dealt with through the Commissioner's office the consumer himself checked the amount lost, by closing off all burners and reading the meter, which registered ten cubic feet per hour. In this case, the relief valve was blowing gas for eight hours. At this rate, if 500 of these regulators were tampered with and allowed to release pressure enough to open the blow-off, the loss would approximate forty-five million cubic feet per annum, or about enough fuel to keep three hundred families for a year.

Controlling Industrial Consumption

Not the least part of the work of restraining excessive consumption has been directed towards reducing the industrial or commercial use of gas. Many refer-

ences to this phase of the Departmental work have been made in previous reports, but it has not been possible heretofore, to publish a comparative table showing the actual decline since the Department first put in force restrictive measures, because the returns have not been available.

TableII—Industrial Consumption of Gas for Four Years.

	cu. ft.
In 1917 the consumption of gas in Industries was	9,124,752,000
" 1918 " " " " " " "	2,744,866,000
" 1919 " " " " " " "	1,584,479,000
" 1920 " " " " " " "	1,423,825,000

These figures demonstrate the effectiveness of the permit system operated under the Natural Gas Act 1919. In the main, the permits have not been abused, otherwise the results shown in Table No. III, could not have been obtained. The reduction of nearly six and a half billion cubic feet of gas in the year 1918, meant that the factories, which relinquished the bulk of this gas, had to substitute some 250,000 tons of coal, and to remodel their furnace equipment in order to change fuels, and this was accomplished while the war was still in progress.

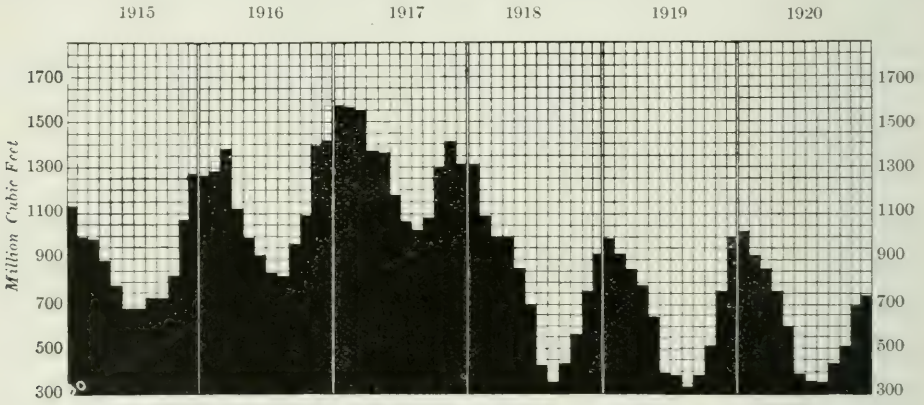

Chart showing monthly consumption of natural gas from the Kent field. 1915-1920 inclusive.

By examining the chart showing the monthly consumption of gas taken from the Kent gas field, for six years, it will be noticed that during the year 1917, the heaviest output of the wells was experienced: the decline during the summer months of that year being negligible, because of the immense industrial consumption shown in Table No. 3. The chart also indicates the effect upon the annual consumption of the withdral of six and a half billion cubic feet from factory use in 1918, to which reference has been made. Summer consumption for the past three years, as shown by this chart, has about reached a normal level, which hereafter will only be affected by varying rates. These rates, if increased, will have a tendency to bring down the higher levels, indicating winter consumption, which no restrictive measures can do.

This chart also indicates this other interesting fact, that if the 1917 consumption had not been regulated when it was, it is very doubtful whether the 1919 and 1920 section of the chart would have appeared in these pages at all.

[1]Rep. Ont. Bur. Mines, Vol. XXVIII, 1919, Pt. 1, p. 61.

The following table is useful in tracing the natural gas supply as it rose and fell during a period of fifteen years.

TABLE III.—NATURAL GAS PRODUCTION FOR 15 YEARS IN MILLION CUBIC FEET

Year	Cu. ft.	Year	Cu. ft.	Year	Cu. ft.
1906	2,534.2	1911	12,311.9	1916	17,929.1
1907	4,155.9	1912	12,454.9	1917	20,026.0
1908	4,483.0	1913	12,558.4	1918	13,067.4
1909	5,388.0	1914	14,062.8	1919	11,195.3
1910	7,263.3	1915	15,212.3	1920	10,545.0

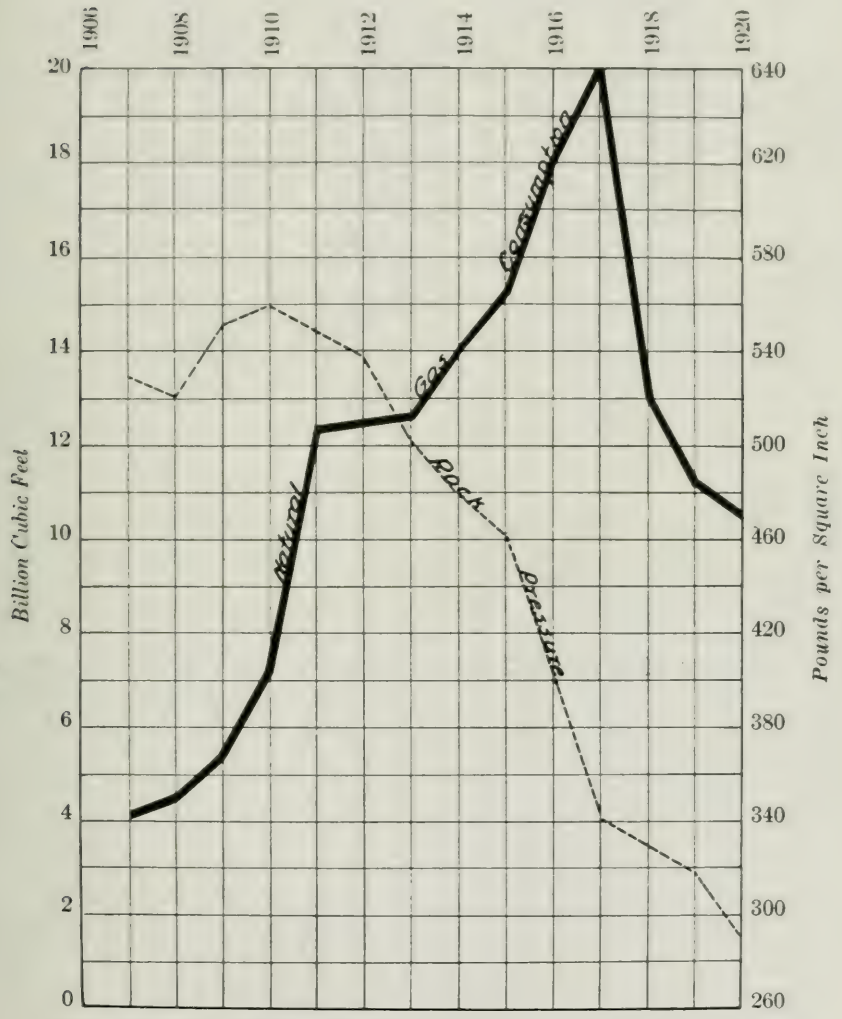

Chart showing relation between consumption and rock pressure.

Another chart indicating the relation of field pressures to consumption requires very little explanation. Although the consumption peak was reached in 1917 and delivery from the fields fell away very rapidly immediately thereafter, the steady decline in field pressures continued. No figures can express more

plainly the great need of a vigorous search for new fields outside of the area affected by these reduced pressures.

Table IV.—Urban Consumption of Natural Gas 1919 and 1920

Municipality	1919	1920
	cu. ft.	cu. ft.
Brantford	251,837,000	175,732,000
Chatham	1,019,916,000	1,014,799,000
Coatsworth	28,772,000	61,495,000
Dresden	66,754,700	78,094,000
Essex	69,165,400	76,691,000
Galt	144,733,000	103,386,000
Hamilton	1,012,292,000	604,116,000
Ingersoll	157,700,000	158,232,000
Kingsville	80,464,000	114,087,000
Leamington	178,495,000	205,509,000
Paris	70,580,000	66,277,000
Petrolia	142,638,300	139,661,100
Ridgetown	79,053,500	104,580,000
Sarnia	597,685,000	603,640,000
Tupperville	7,740,500	10,807,000
Tilbury	74,111,000	70,987,000
Tecumseh	23,605,400	22,574,000
Windsor	1,754,223,000	1,611,640,000
Woodstock	194,371,000	159,947,000
Wheatley	35,739,000	42,585,000
Total	5,989,875,800	5,424,839,100

Field Measurements

Table V showing "open-flow" measurements, refers to the method gas operators use, in "feeling the pulse" of each well. The term "open-flow" has given rise to considerable misunderstanding when used by those not accustomed to the operations of a gas field. The following explanation will perhaps help to make the use of the table plain.

The open-flow of a gas well is the amount of gas that is blown from the open well into the air; this flow is measured by a "U" gauge containing either water or mercury. One end of the "U" gauge is held in the gas stream, and the displacement of mercury or water caused by pressure, is recorded in inches and tenths. The flow of gas is worked out per 24 hours by applying the gauge-reading to a table which takes into account the size of the outlet, etc. It is misleading to the public to quote the output of a gas well measured in this way as representing the merchantable production of the well, because after the gas-flow is inclosed and flowing against the line pressure on its way to service, the actual delivery of the wells is only a fraction of the "open-flow."

TABLE V.—OPEN FLOW MEASUREMENT OF GAS WELLS IN KENT COUNTY

The Table refers to the Tilbury gas field only, and the well measurements are 162 cubic feet per 24 hours.

	1916	1917	1918	1919	1920
Union Natural Gas Co....	116 Wells	132 Wells	134 Wells	133 Wells	136 Wells
	69,042,388	58,165,100	40,086,647	33,773,487	23,346,764
Percentage of Decline....		16 per cent	31 per cent	17 per cent	30 per cent
Glenwood Natural Gas Co	82 Wells	92 Wells	91 Wells	99 Wells	106 Wells
	60,128,000	93,319,080	28,198,926	22,863,000	16,980,000
Percentage of Decline or Increase.		55 per cent increase.	70 per cent decline.	20 per cent decline.	27 per cent decline.

This system of measuring gas in the field is useful in keeping check upon the behaviour of a well and in watching its decline. As all wells have to be "blown down" to a normal flow before the gauge is applied, the condition of the well whether wet, dry, or showing oil and so on, is indicated, and treatment may be decided upon for the season.

Table V indicates the pronounced failing of the Tilbury wells over a period of five years. In 1917 the Glenwood field showed 55 per cent. increase over the 1916 measurements. This was due to the fact that among the ten new wells added to the field, one well which gauged thirteen million cubic feet per twenty-four hours was brought in. It did not long survive, as the figures show. The varying number of the wells has to be considered in using the comparison in the table because it is constantly changing, new ones being added, abandoned wells plugged, and some being laid up for repairs.

The figures in Table V show in an impressive way the need of retrenchment in the field of consumption if the amount of gas remaining in this locality is going to meet the "peak demand" another year. It will also be seen at a glance that a reduction in the consumption of available gas became an absolute necessity when the first serious shortage occurred in 1917-18, in order that the domestic requiremets might be met at critical periods.

Effects of Price on Consumption

In dealing with the work of regulating consumption, it is necessary to refer to the controlling influence that price has upon the consumption of gas. The following list of municipalities and towns shows the disparity of rates at which natural gas was produced and sold in the different sections of the gas area. The rates given were in force during 1919 and 1920 generally, and are quoted here for statistical purposes also for comparison with some higher rates since established, with reference to the effect upon conservation.

CITIES AND TOWNS USING GAS, AND RATES CHARGED IN 1919 AND 1920

Place	Distributing Company	Rate per M. cu. ft.	
Attercliffe	Dominion Natural Gas Company	.40	
Ancaster	Manufacturers Natural Gas Co. Ltd	.80	
Acacia	Dominion Natural Gas Company		
Aylmer	Central Pipeline Company	.40	.60
Bridgeburg	Provincial Natural Gas Company	.50	
Binbrook	Binbrook Gas Company	.40	
Blackheath	Dominion Natural Gas Company	.25	
Blenheim	Union Natural Gas Company...	.25	
Brigden	Union Natural Gas Company...	.30	
Baldoon			
Buxton North	Glenwood Natural Gas Company	.15	
Buxton South	Glenwood Natural Gas Company	.15	
Belle River	Union Natural Gas Company	.30	
Brantford	Brantford Gas Company	.80	
Belmont	Belmont Gas-Light Company	.70	
Bartonville	Dominion Natural Gas Company	.40	
Chippawa	Chippawa Development Company		
Crowland			
Crystal Beach	Provincial Natural Gas Co.	.75	
Caledonia	Port Colborne-Welland N. G. Co.	.40	
Caistorville		.25	
Cedar Springs	Union Natural Gas Company	.15	
Coppleston			
Corunna	Union Natural Gas Company	.30	
Courtright	Union Natural Gas Company	.30	
Chatham	Chatham Gas Company	.25	
Charing Cross	Union Natural Gas Company	.15	.20
Coatsworth	Glenwood Natural Gas Company	.15	
Comber	Union Natural Gas Company	.30	
Cottam	Beaver Oil & Gas Company	.25	
Clanbrassil			
Cayuga	Dominion Natural Gas Company	.45	
S. Cayuga	" " " "	.40	
Cainsville	" " " "	.30	
Cheapside	" " " "	.25	
Chedoke	" " " "	.70	
Dunnville	" " " "	.40	
Dundas	" " " "	.70	
Dover Centre	Union Natural Gas Company	.25	
Dealtown	" " " "		
Dresden	" " " "	.30	
Decewsville	" " " "		
Delhi	Dominion Natural Gas Co.	.45	
Dorchester	Southern Ontario Gas Co.	.40	
Dutton	Southern Ontario Gas Co.	.30	
Elfrida	Dominion Natural Gas Co.	.40	
Essex	Union Natural Gas Co.	.30	
Eden	Dominion Natural Gas Co.	.40	
Elmstead	Union Natural Gas Co.		
Fonthill	United Gas Co.	.75	
Fletcher	Union Natural Gas Co.	.15	
Ford	Windsor Gas Co.	.30	
Fisherville	Fisherville Gas Co.		
Frome	Southern Ontario Gas Co.	.35	
Fingal	Southern Ontario Gas Co.	.35	
Fenwick	United Gas Co.	.75	
Fort Erie	Provincial Gas Co.	.50	
Fairground	Dominion Natural Gas Co.	.45	
Guild	Union Natural Gas Co.	.15	
Galt	Dominion Natural Gas Co.	.80	
Humberstone	Sterling Natural Gas Co.	.75	
Hamilton	United Gas & Fuel Co.	.75	
	Dominion Natural Gas Co.	.75	
Hannon	National Gas Company		

List of Cities and Towns, etc. *Continued.*

Place	Distributing Company	Rate per M. cu. ft.
Highgate	Southern Ontario Gas Co.	.20
	Union Natural Gas Co.	.25
Hagersville	Manufacturers Nat. G. Co. Ltd.	.50
Hepworth	Northern Gas & Gasoline Co.	
Ingersoll	Ingersoll Gas-Light Co.	.80
Iona	Southern Ontario Gas Co.	.35
Jeanette's Creek	Union Natural Gas Co.	.20
Jarvis	Dominion Natural Gas Co.	.45
Kingsville	Beaver Oil & Gas Co.	.25
Kobler		
Lythmore	Dominion Natural Gas Co.	.40
Logierait		
Leamington	Beaver Oil & Gas Co.	.25
Lynne Valley	Dominion Natural Gas Co.	.45
Lyndoch	Doninion Natural Gas Co.	.45
London	Southern Ontario Gas Co.	.45
Lambeth	Southern Ontario Gas Co.	.45
Lowbanks	Sterling Natural Gas Co.	.25
Merritton	United Gas Companies.	.75
Muirkirk	Southern Ontario Gas Co.	.20
Mull		
Morpeth	Union Natural Gas Co.	.20
Mandamin		
Merlin	Glenwood Nat. G. Co. & Union Co.	.15
Maidstone	Union Natural Gas Co.	.25
Marshville		
Mount Salem	Southern Ontario Gas Co.	
Marthasville	Union Natural Gas Co.	
Niagara Falls	Provincial Natural Gas Co.	.50
North Ridge	Beaver Oil & Gas Co.	.25
Nelles Corners	Dominion Natural Gas Co.	.25
Nanticoke	Dominion Natural Gas Co.	.25
North Oxford	Southern Ontario Gas Co.	.80
Ouvry	Union Natural Gas Co.	.25
Olinda	Beaver Oil & Gas Co.	
Oli Springs	Oil Springs Oil & Gas Co.	
Onondaga	Dominion Natural Gas Co.	.80
Oldcastle		
Prairie Siding	Union Natural Gas Co.	.15
Palmyra	Union Natural Gas Co.	.25
Petrolia	Petrolia Utilities Co.	.30
Paris	Dominion Natural Gas Co.	.80
Putname	Southern Ontario Gas Co.	.60
Power Glenn		
Pelham N	United Gas Co.	.75
Point Abino		
Point Edward	Sarnia Gas Co.	.30
Paincourt	Union Natural Gas Co.	.25
Ridgeway	Bertie Natural Gas Co.	
Rychmans	Dominion Natural Gas Co.	.35
Rodney	Southern Ontario Gas Co.	.28
Ridgetown	Union Natural Gas Co.	.25
Rondeau		
Romney	Union Natural Gas Co.	
Ruscomb	Union Natural Gas Co.	
Ruthven	Beaver Oil & Gas Co.	.25
Rainham Centre	Dominion Natural Gas Co.	.25
Rosehill	Rosehill Natural Gas Co.	.75
Ridgeville	United Gas Companies.	.75
Stevensville	Provincial Natural Gas Co.	.75
Sherkston	Provincial Natural Gas Co.	.50
Stromness		
Sinclairville		.25
Shetland	Shetland Gas Co.	

List of Cities and Towns, etc. *Continued.*

Place	Distributing Company	Rate per M. cu. ft.
Sarnia	Sarnia Gas Co.	.30
Sombra	Union Natural Gas Co.	.30
Sandwich	Windsor Gas Company	.30
Selkirk	Dominion Natural Gas Co.	.25
Springvale	Gas & Oil Co. of Springvale.	
Simcoe	Dominion Natural Gas Co.	.45
Straffordville	Dominion Natural Gas Co.	.40
Shedden	Southern Ontario Gas Co.	.35
St. Catharines	United Gas Companies.	.75
St. George	Dominion Natural Gas Co.	.80
St. Jacobs		
St. Williams	Dominion Natural Gas Co.	.45
St. Joachim	Union Natural Gas Co.	.25
Thorold	United Gas Companies, Ltd.	.75
Tilbury	Union Natural Gas Co.	.25
Tecumseh	Union Natural Gas Co.	.25
Tupperville	Union Natural Gas Co.	.30
Tillsonburg	Dominion Natural Gas Co.	.45
Talbotville	Southern Ontario Gas Co.	.35
Valetta	Union Natural Gas Co.	.15
Vittoria	Dominion Natural Gas Co.	.45
Vienna	Dominion Natural Gas Co.	.40
	Central Pipeline Co.	.15
Welland	Provincial Natural Gas Co.	.50
	Industrial Natural Gas Co.	
Wellandport	J. A. Coleman	
Woodburn	Woodburn Gas Co.	.30
Wilkesport	Union Natural Gas Co.	
Wallaceburg	Wallaceburg Gas Co.	
Wheatley	Beaver Oil & Gas Co.	.25
Woodslee	Union Natural Gas Co.	
S. Woodslee	Union Natural Gas Co.	.25
Windsor	Windsor Gas Co.	.30
Walkerville	Windsor Gas Company	.30
Willow Grove		
Woodstock	Woodstock Gas-Light Co.	.80
Wilton Grove		
Wallacetown	Southern Ontario Gas Co.	.28
West Lorne	Southern Ontario Gas Co.	.28
Winger	Provincial Natural Gas Co.	
Port Burwell	Dominion Natural Gas Co.	.47
	Central Pipeline Co.	.23
Port Colborne	Sterling Natural Gas Co.	.52
Port Maitland	Dominion Natural Gas Co.	.25
Port Lambton	Union Natural Gas Company	.30
Port Ryerse	Dominion Natural Gas Co.	.45
Port Dover	Dominion Natural Gas Co.	.45
Port Rowan	Dominion Natural Gas Co.	.45
Port Royal	Dominion Natural Gas Co.	.45
Townships and Localities		
Drake Road	Glenwood Natural Gas Co.	.15
Middle Road Extension	Glenwood Natural Gas Co.	.20
Maple City Oil Co.	Glenwood Natural Gas Co.	.15
8th Concession, Raleigh Township	Glenwood Natural Gas Co.	.25
Westminster Township	Southern Ontario Gas Co.	.45
Southwold Township	Southern Ontario Gas Co.	.35
Dunwich Township	Southern Ontario Gas Co.	.28
Aldboro Township	Southern Ontario Gas Co.	.25
Orford Township	Southern Ontario Gas Co.	.20
Howard Township	Southern Ontario Gas Co.	.20
Raleigh Township	Southern Ontario Gas Co.	.15
Harwich Township	Southern Ontario Gas Co.	.15

While the efforts of the Department have been constantly directed toward the control and reduction of excessive consumption so that the partially exhausted fields might have a chance for longer life the work has been carried on mainly under the system of restriction provided in the statute. But the effective consumption governing principle of rate adjustment could not be applied, because the statute provides no powers to deal with the price at which natural gas should be bought or sold. Just how the price automatically effects consumption is shown in Table Number VI. The figures given represent the quantity of gas consumed per customer per annum. The steady fall in consumption as the price increases is most significant.

Table VI.—How Rates Affect Consumption.

	Cu. ft.
25 cents	161,000
30 "	143,000
35 "	128,000
40 "	114,000
45 "	102,000
50 "	92,000
60 "	75,000
75 "	57,000
$1.00	39,000

It is curious to note how the total domestic consumption works out when applied to the average rate. The average of all gas rates given in the list of Cities and Towns is 38.2 cents per thousand cubic feet, and this rate applied to Table VI works out at approximately 121,000 cubic feet consumed by each consumer in the year. This is confirmed by applying the rate to the curve in chart on page 15, also by comparing it with Table VIII which gives the actual amount consumed during 1918, 1919 and 1920 in various localities. The total amount of domestic gas consumed in the Province in 1920 divided by an estimated number of domestic consumers as shown in Table No. VII. gives 121,600 cubic feet used by each consumer per annum.

Table VII.—Relation of Total Consumers to Quantity Consumed.

	cu. ft.
Total consumption in Ontario, 1920	10,545,000
Less total industrial consumption	1,424,000
	9,121,000
Approximate total consumers	80,000
Less commercial users	5,000
Domestic users	75,000

$$\frac{75{,}000}{9{,}121{,}000} = 121{,}600 \text{ cu. ft. per consumer per annum.}$$

Again, if the 75,000 domestic consumers used 9,121,000 thousand cubic feet in 1920 for which they paid 38.2 cents per thousand cubic feet, the same consumers would use only 4,275,000 thousand cubic feet if they paid 75 cents per thousand cubic feet, because at the seventy-five cent rate their annual gas consumption would be 57,000 cubic feet each according to the rates given in Table VI. At 38.2 cents per thousand cubic feet the 75,000 domestic consumers burned 9,121,000 thousand cubic feet, for which they paid $3,484,222. At 75 cents per thousand cubic feet they would burn 4,275,000 thousand cubic feet, for

which they would pay $3,206,250. The advantage is obvious; approximately one half of the amount of gas would be used by the consumers at a 75-cent rate, and the available supply would last twice as long.

For the purpose of comparing the rate effect upon consumption, Table VIII is given here showing actual returns from several localities in Ontario where gas was sold at varying rates, and the amounts used per consumer.

Table VIII.—Actual Quantities Consumed Under Various Rates.

Place	Year	Rate	No. of Consumers	Average Annual Consumption Per Capita
				cu. ft.
Ingersoll	1918	37.5	1,197	129,160
Ingersoll	1919	44.8	1,217	118,614
Simcoe	1918	29.1	2,751	145,176
Simcoe	1919	34.5	2.727	124,661
Southern Ont. System	1920	15.0	106	164,424
Southern Ont. System	1920	20.	219	151,104
Southern Ont. System	1920	28.	519	149,376
Southern Ont. System	1920	30.	251	156,468
Southern Ont. System	1920	35.	231	126,336
Southern Ont. System	1920	40.	375	127,234
Southern Ont. System	1920	80.	11,067	45,191
Port Colborne System		20.		174,000
Port Colborne System		25.		162,000
Port Colborne System		40.		104,000
St. Catharines		73.		53,000

The chart[1] on page 15 puts the whole relationship of consumption to price in such plain form that the decrease in consumption consequent upon the increase of price, can be seen at a glance.

The general trend of the curve in this chart demonstrates also that as the higher prices are reached and natural gas passes into the luxury class, so the variation in comsumption becomes more gradual. That portion of the curve indicating the decrease in consumption from a dollar up would show approximately the same variation in the case of high grade artificial gas.

Loses by Defective Methods of Consumption

While the Department has given much consideration to statutory control of excessive consumption, the question of economical methods of consumption was not lost sight of during the year. It has been found that many consumers unconsciously waste at least twenty-five per cent. of the gas they pay for, because of the want of a little attention to the adjustment and condition of the equipment in which it is consumed. This is putting the loss at a conservative figure. Some startling statements have been given out from time to time by natural gas engineers dealing with the waste of gas in unsuitable and badly regulated burning equipment. This is how one eminent authority puts it: "The waste in the average cooking stove is about eighty-seven per cent. of the gas received."

[1] Information for this chart was supplied through the courtesy of H. R. Davis, General Manager, Dominion Natural Gas Company, Buffalo.

With a view to checking up some of the conditions under which cooking gas was being used, the Department caused an inspection to be made in February, 1920. The inspector in charge of this work selected representative streets of a certain city with a view to getting an average of conditions over the whole city area. Eighty-three residences were visited, and the cooking appliances examined with the following results:—

18.0	per	cent.	required cleaning of burners.
25.3	"	"	required more air.
2.5	"	"	required position of mixer changed.
32.5	"	"	in good condition.
1.2	"	"	used hydro for cooking.
1.2	"	"	new equipment.
16.8	"	"	were using wood or coal with gas.
2.5	"	"	were in fair order.
100.0			

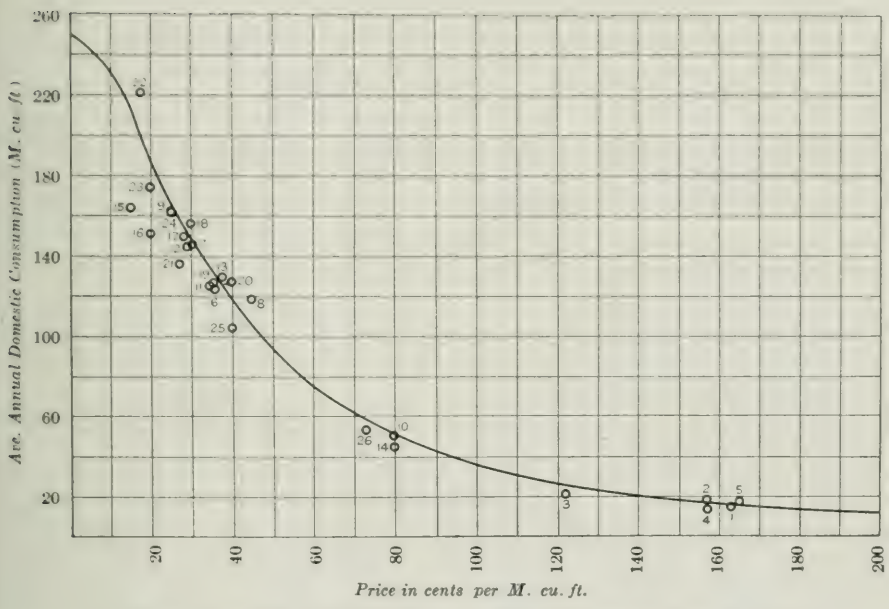

Chart showing relation of natural gas consumption to price.

It will be noted that 45.8 per cent. of these appliances were in bad order, and it is more than possible that many of the 16.8 per cent. using wood or coal with gas, were also out of order. For a conservative estimate of waste paid for by the householder, the defective 45.8 per cent. is added to a small proportion of the 16.8 to bring it up in round numbers to 50 per cent. Let us apply this to the whole cooking consumption of the Province for 1920, as follows:—

The total consumption of gas is divided into summer and winter periods, and the industrial consumption is deducted mainly from the summer portion, being confined principally to the warm months. The cooking gas is computed by doubling the consumption of the warm months, less the industrial, which gives approximately the following result:

	cu. ft.
Cooking Gas	6,210,800,000
Industrial Gas	1,424,000,000
Heating Gas	2,910,200,000
Total consumption for the Province for 1920	10,545,000,000

If we take the 45.8 per cent. defective cooking stoves before mentioned, and assume that there were enough defectives among the 16.8 per cent. using combined fuel to bring the total up to 50 per cent., we shall be close enough for the purpose of this calculation and was within the mark. Applying the 50 per cent. representing the defective cooking stoves, with the low estimated loss by improper combustion of 25 per cent., to the total cooking consumption for 1920, we find that 3,493,575,000 cubic feet were consumed by the fifty per cent. defectives and 2,717,225,000 cubic feet were consumed by the other 50 per cent., making up the aforementioned cooking total of 6,210,800,000 cubic feet. Therefore, a 25 per cent. loss through defective combustion represents a needless waste of about 21,000 cubic feet per defective cook-stove per year; or a total of gas paid for by the consumers from which no benefit was derived, of 776,350,000 cubic feet which at 38.2 cents per thousand cubic feet means unnecessary gas bills in this one item alone of approximately $295,565 in one year.

This startling result is based upon the assumption that the average of 50 per cent. defective apparatus shown in the eighty-three stoves examined, would apply to the whole Province.

There is no doubt that the amount of waste through improper combustion in ordinary cooking stoves to the amount indicated, possibly far more, is going on all the time, and that some effectual means of teaching consumers how to use gas economicaly should be carefully considered. Literature has been published and sent into every home, but still the waste goes on. A proportion of this inexcusable waste can be accounted for by the prevalence of low-priced gas, but not all. Gas which costs 25 cents per thousand cubic feet will be used with less attention to economy than gas which costs $1, on the same principle that tap water supplied by the city at say $2 per quarter is allowed to run from the tap without any attempt being made to utilize the whole amount passing through the tap; but if the size of the quarterly bill depended on the quantity of water drawn, more attention would be paid to turning the tap off.

Just what is the best way of meeting this and many other problems connected with needless waste of gas has been given much attention by administrative bodies, and by the gas interests as well, in the United States. The general opinion appears to be that higher rates are having the effect of making consumers more careful but not careful enough, and that it is necessary to deal with the apparatus itself by competent adjusters and experts, which of course is costly and takes time. With our reduced gas supply, some attempt will be necessary to show people how to obtain better combustion; this will appeal to consumers as more necessary when rates become higher, but the use of gas under lower distribution pressures will mean still greater necessity for adjustment of the burners. It is safe to say that natural gas will have to be consumed under constantly decreasing service pressure as the fields decline; this is the history of all gas fields.

Total Value of Natural Gas Consumed Since 1906

The total amount of natural gas consumed by the people of Ontario for the past fifteen years is in round numbers, 163,000,000,000 cubic feet, equivalent approximately, to 7,000,000 tons of coal. If an average rate of 20 cents was paid for this gas, then it cost the consumers $32,000,000 while the equivalent in coal of $7.00 per ton would have cost them, $49,000,000. The money for coal would have gone chiefly to the United States with a small proportion to other provinces, and freight would have been paid on it all. Added to this is the cost of stoking and removing the ashes. Putting this in another way, it may be said that by using gas instead of coal, the saving to the natural

gas consumers of this Province amounts to about $1,133,000 per annum for the last fifteen years on a basis of the rates given in the foregoing calculation.

These figures are based upon typical prices, because it is nearly impossible to strike the actual rate at which all the gas was sold. Prices vary from time to time, and in the early days of the industry, gas was often sold at flat as well as graduated rates. It is quite probable that the gas rate quoted is high, but if a lower rate were used, it would only show a greater saving.

Licenses in the Gas Industry

There are five operations connected with the Natural Gas industry that are conducted under special annual license, the fee for which is ten dollars. These are (1) Leasing and Prospecting; (2) Operating Drilling Outfits; (3) Producing Operations; (4) Distributing Operations; (5) Operation of Pipelines. Thirty-eight licenses for "leasing and prospecting" were taken out for the year 1920 according to the following list:—

Operators Licensed to Lease and Prospect for Natural Gas 1920

License No.	Name	Address
47	Ajax Oil and Gas Co. Ltd.	Rowntree Bldg., Toronto, Ont.
39	Barr, D.	298 Talbot St., St. Thomas, Ont.
30	Beaver Oil and Gas Co.	Brantford, Ontario, (Buffalo, N.Y.)
34	Bermingham, T. F.	Hamilton, Ontario.
28	Castle Oil and Gas Co.,	Imperial Bank Bldg., Niagara Falls, Ont.
43	Central Development Co.	Chatham, Ontario
50	Cornish, J. H.	60 Summerhill Gardens, Toronto, Ont.
49	Diener, Eugene F.	R. R. No. 5, Dunnville, Ontario.
29	Dominion Natural Gas Co.,	Brantford, Ontario, (Buffalo, N.Y.)
45	Eureka Oil and Gas Co.	1804 Royal Bank Bldg., Toronto, Ont.
21	Frontier Oil and Gas Co. Ltd.	211 Liberty Bldg., Buffalo, N. Y.
31	Glenwood Natural Gas Co.	Brantford, Ont. (Buffalo, N.Y.)
51	Irvine, J. J.	Dunnville, Ontario.
48	Inland Oil & Gas Co. Ltd., E. P. Rowe, Sec.	608 Lumsden Bldg., Toronto, Ont.
38	Industrial Natural Gas Co.	Thorold, Ontario.
35	Jasperson, B.	Kingsville, Ontario.
55	Keyser, Bert L.	21 London St., Toronto, Ont.
22	Leeds, J. H.	Wellandport, Ontario.
42	Minor, L. E.	Smithville, Ontario.
36	May, A. G.	75 Melrose Ave., Hamilton, Ontario.
53	Mercer, F. D.	Toronto, Ontario.
23	Maple Leaf Oil and Gas Co.	48 St. John's Place, Buffalo, N.Y.
46	Northern Gas & Gasoline Co.	Hepworth, Ontario.
44	Petrol Oil & Gas Co., Ltd.	608 Lumsden Bldg., Toronto, Ont.
33	Provincial Natural Gas & Fuel Co.	Niagara Falls, Ont.
32	Pilkington Bros.	Thorold, Ontario.
24	Progressive Oil & Gas Co.	Room 38, Sun Life Bldg., Hamilton, Ont.
52	Peck, C. A.	96 Woolfrey Ave., Toronto, Ontario.
27	Quillinan, J. A.	Drawer 110, Imperial Bank Bldg., Niagara Falls.
25	Stewart, Alex.	Box 124, Windsor, Ontario.
37	Snively, F. L.	90 Melrose Ave., Hamilton, Ontario.
57	Universal Gas & Oil Co., Ltd.,	c/o Millar, Ferguson & Hunter, Crown Life Bldg., Toronto.
26	Union Natural Gas Company	Chatham, Ontario.
58	Valley Oil & Gas Co.	42 Home Bank Bldg., Hamilton, Ont.
56	Western Counties Gas Co.	E. C. Biden, Mgr. Dunnville, Ontario.
54	Winger, S. W.	R. R. 4, Hagersville, Ontario.
41	Waugh, S. A.	Fort Erie, Ontario.
40	Williams, A.	Ruthven, Ontario.

This is an increase of 19 operators over 1919.

Fifty-three operators took out "Producer's" Licenses as follows:—

Operators Licensed to Produce National Gas,1920.

License No.	Name	Address
88	Aldrich Gas & Oil Co.,	c/o Bruce & Counsell, Merchant's Bank Bldg., Hamilton, Ontario.
100	Beer, George	Binbrook, Ontario.
55	Beaver Oil & Gas Co.	Brantford, Ontario, (Buffalo)
95	Bertie Natural Gas Co.	Ridgeway, Ontario.
86	Battle, Martin	Sun Life Bldg., Hamilton, Ont.
96	Binbrook Gas Co.	N. Laidman, Binbrook, Ontario.
53	Castle Oil & Gas Co.	Niagara Falls, Ontario.
77	Chippawa Development Co.	Chippawa, Ontario.
60	Chippewa Oil & Gas Co.	Tavistock, Ontario.
92	Coleman, J. A.	Wellandport, Ontario.
64	Canfield Natural Gas Co.	Canfield, Ontario.
52	Canby, B. F.	R. R. No. 2, Marshville, Ontario.
76	Duxbury, Wellington	R. R. No. 1, Hagersville, Ont.
59	Darling Road Co-Operative Natural Gas Co.	Canfield, Ontario.
87	Dunn Natural Gas Co.	Dunnville, Ontario.
54	Dominion Natural Gas Co.	Brantford, Ontario (Buffalo)
99	Diener Gas & Manufacturing Co.	Dunnville, Ont., c/o Robt. Bradford.
63	Empire Limestone Co.	191 Hudson St., Buffalo, N.Y.
58	Emerson, Laidlaw & Troughton.	Attercliffe Station, Ont.
102	Eastside Gas Company.	Lowbanks, Ontario.
56	Glenwood Natural Gas Co.	Brantford, Ontario, (Buffalo.)
75	Hamilton Gas & Oil Co.	602 Spectator Bldg., Hamilton, Ont.
98	Hendee Gas Co.	c/o J. V. Fradenburg, Sec., Cayuga, Ontario.
82	Industrial Natural Gas Co.	Thorold, Ontario.
73	Jasperson, B.	Kingsville, Ontario.
94	Kindy, D. & Sons	Selkirk, Ontario.
93	Kindy Gas Company	R. R. No. 2, Cayuga, Ontario.
68	Lalor & Vokes	Dunnville, Ontario.
69	Lalor, F. R.	Dunnville, Ontario.
71	Liesinger & Lembke	42 Linden Park, Buffalo, N.Y.
78	Lamb, A.	Selkirk, Ontario.
79	Midfield Natural Gas Co.	Hamilton, Ontario.
90	Medina Natural Gas Co.	Chatham, Ontario.
85	Marshall, J.	Hamilton, Ontario.
81	National Gas Company	Hamilton, Ontario.
89	North Shore Gas Co.	c/o Bruce & Counsell, Hamilton, Ont.
51	Northern Gas & Gasoline Co.	Hepworth, Ontario.
74	Ontario Gypsum Company	Paris, Ontario.
66	Oil Springs Oil & Gas Co.	Oil Springs, Ontario.
67	Provincial Natural Gas Co.	Niagara Falls, Ontario.
80	Port Colborne-Welland Natural Gas Co.	Port Colborne, Ont.
62	Pilkington Bros.	Thorold, Ontario.
61	Petrol Oil & Gas Co.	1804-6 Royal Bank Bldg., Toronto, Ont.
72	Rolston & Bennett	Dunnville, Ontario.
101	Richmond Gas Co.	Chatham, Ontario.
83	Relief Gas Co., Ltd.	St. Catharines, Ontario.
91	Sparham, A. F.	R. R. No. 1, Caledonia, Ontario.
70	Sterling Natural Gas Co.	Port Colborne, Ontario.
97	Stevensville Natural Gas Co.	Stevensville, Ontario.
50	Union Natural Gas Co.	Chatham, Ontario.
57	United Gas Companies	St. Catharines, Ontario
65	Vacuum Oil & Gas Co.	608 Lumsden Bldg., Toronto.
84	Wainfleet & Moulton,	R. R. No. 1, Lowbanks, Ontario.

There was an increase of four in the list of producers over those operating in 1919.

Drilling Rig operations were licensed to the number of twenty-six; an increase of three over 1919.

Operators Licensed to Drill or Bore for Natural Gas, 1920

License No.	Name	Address
29	Coleman, J. A.	Wellandport, Ontario.
30	Dominion Natural Gas Co.	Brantford, (Buffalo) No. 1.
31	Dominion Natural Gas Co.	Brantford, (Buffalo) No. 2.
49	Dundas Oil & Gas Co. Ltd.	807 Lumsden Bldg., Toronto.
38	Featherstone, C. W.	Canboro, Ontario, No. 1.
39	Featherstone, C. W.	Canboro, Ontario, No. 2.
32	Glenwood Natural Gas Co.	Brantford, Ont., (Buffalo.) No. 1.
33	Glenwood Natural Gas Co.	Brantford, Ont., (Buffalo) No. 2.
41	Industrial Natural Gas Co.	Thorold, Ontario.
24	Imperial Oil Co., Ltd.	56 Church St., Toronto.
45	Inland Oil & Gas Co.	502 Kent Bldg., Toronto.
35	Jasperson, B.	Kingsville, Ont.
44	Kiser, W. H. & Louer	Tillsonburg, Ontario.
25	McCutcheon, Thos. J.	Dunnville, Ontario.
43	McLister, J. J.	Dunnville, Ontario.
42	McKillop, Wm.	Hepworth, Ontario.
36	May, A. G.	75 Melrose Ave., Hamilton, Ontario.
34	Provincial Natural Gas Co.	Niagara Falls, Ontario.
26	Snively, F. L.	90 Melrose Ave., Hamilton, Ontario.
37	Snively, F. L.	90 Melrose Ave., Hamilton, Ontario.
27	Stewart, Alex	Box 124, Windsor, Ontario.
40	Stover Drilling Co., F. H.	110 Canfield Ave., Detroit, Michigan.
48	Snively, F. L.	90 Melrose Ave., Hamilton, Ontario.
47	Sparham, A. F.,	R. R. No. 1, Caledonia, Ontario.
28	Union Natural Gas Company	Chatham, Ontario.
46	Universal Gas & Oil Co., Ltd.	c/o Millar, Ferguson & Hunter. Crown Life Bldg., Toronto, Ont.

Nine Pipe-line licenses were issued, there being no increase in this division of the industry.

Companies Licensed to Operate Natural Gas Pipe-Lines, 1920.

License No.	Nane	Address
14	Beaver Oil & Gas Company,	Brantford, Ontario, (Buffalo).
12	Castle Oil & Gas Company	Niagara Falls, Ontario.
18	Central Pipeline Company	Chatham, Ontario.
13	Dominion Natural Gas Co.	Brantford, (Buffalo.)
15	Glenwood Natural Gas Co.	Brantford, Ontario, (Buffalo.)
11	Northern Pipeline Company	Chatham, Ontario.
16	Southern Ontario Gas Company	Brantford, Ontario, (Buffalo.)
17	United Gas Companies	St. Catharines, Ontario.
10	Union Natural Gas Company	Chatham, Ontario.

Distributing Licenses to the number of forty-three were issued. an increase of four over those operating in 1919.

Operators Licensed to Distribute Natural Gas, 1920

License No.	Name	Address
68	Azoff Natural Gas Company	A. Baker, Treas., Canfield, Ontario.
80	Beer, George	Binbrook, Ontario.
75	Bertie Natural Gas Company	Ridgeway, Ontario.
60	Belmont Gas & Light Company,	Belmont, Ontario.
50	Brantford Gas Company	Brantford, Ontario, (Buffalo.)
46	Beaver Oil & Gas Company	Brantford, Ontario, (Buffalo.)
78	Binbrook Gas Company	N. Laidman, Binbrook, Ontario.
43	Coleman, J. A.	Wellandport, Ontario.
72	Central Pipeline Company	Chatham, Ontario.
62	Chippawa Development Company	Chippawa, Ontario.
65	Corporation of Town of Leamington	Box 209, Leamington, Ont.
61	Chatham Gas Company	Chatham, Ontario.
44	Castle Oil & Gas Company	Niagara Falls, Ontario.
81	Chippawa Oil and Gas Co.	Tavistock, Ontario.
45	Dominion Natural Gas Co.	Brantford, Ontario, (Buffalo.)
69	Dunn Natural Gas Co.	Dunnville, Ontario.
79	Erie Beach Gas Company	Chatham, Ontario.
70	Fisherville Gas Company	Fisherville, Ontario.
74	Gas & Oil Co. of Springvale	Hagersville, Ontario
47	Glenwood Natural Gas Co.	Brantford, Ontario, (Buffalo.)
82	High Grade Natural Gas Company	c/o R. L. Pattinson, Chatham, Ont.
66	Industrial Natural Gas Company	Thorold, Ontario.
52	Ingersoll Gas Light Company	Ingersoll, Ontario, (Buffalo.)
77	Lake Shore Natural Gas Company	294 Baynes St., Buffalo,
63	Midfield Natural Gas Co.	9 Maple Ave., Hamilton, Ont.
53	Manufacturers' Natural Gas Co.	Brantford, Ont. (Buffalo.)
42	Northern Gas & Gasoline Co.	Hepworth, Ontario.
55	Oil Springs Oil & Gas Company	Oil Springs ,Ontario.
40	Petrolia Utilities Company	Petrolia, Ontario.
56	Provincial Natural Gas & Fuel Co.	Niagara Falls, Ontario.
64	Port Colborne-Welland Natural Gas Co.	Port Colborne, Ontario.
67	Relief Gas Company	St. Catharines, Ontario.
71	Rosehill Natural Gas Co.	Buffalo, N.Y.
59	Sterling Gas Company	Port Colborne, Ontario.
54	Sarnia Gas Company	Sarnia, Ontario.
76	Shetland Gas Company	Florence, Ontario.
48	Southern Ontario Gas Company	Brantford, Ontario, (Buffalo.)
41	Union Natural Gas Company	Chatham, Ontario.
49	United Gas Companies,	St. Catharines, Ontario.
58	United Gas & Fuel Company	Hamilton, Ontario.
57	Windsor Gas Company	Windsor, Ontario.
73	Wallaceburg Gas Company,	Wallaceburg, Ontario.
51	Woodstock Gas Light Co.	Woodstock, Ont., (Buffalo).

In all, there were issued one hundred and sixty nine gas licenses for the year 1920.

During the three years that the Department has had jurisdiction over the Natural Gas service of the Province, two main problems have had to be constantly dealt with:—

(A).—Judicious restraining of excessive consumption:

(B).—Protecting the remaining supply.

The following remarks refer to different phases coming more particularly under "B."

Water Problem in the Gas Wells of Kent County

The life of the Tilbury gas fields is very seriously threatened by rock water which is constantly flowing into the wells. The influx of this water is somewhat retarded by maintaining as high a field pressure as possible, but as the general field pressure declines, the water increases. Table IX shows the annual decline of rock pressures.

TABLE IX.— ROCK PRESSURES, TILBURY GAS FIELD

Year	1913	1914	1915	1916	1917	1918	1919	1920
Lbs.	512	491	475	434	368	330	318	291

The conditions under which gas is usually encountered in this field do not admit of providing a pocket of sufficient depth to act as a reservoir for the water; for this reason frequent pumping has to be done. At the beginning of the year one gas company operated 166 producing wells in the Tilbury gas area, Kent county, 121 of which were more or less flooded, as outlined in Table X.

TABLE X.—PERCENTAGE OF WET WELLS IN TILBURY FIELD

Total Producing Wells	166
Equipped with pumps and syphons	91—or 55 per cent.
Requiring Pumping Equipment	23—or 14 per cent.
Showing Moisture	7—or 4 per cent.

This shows that 121 wells out of 166, or 73 per cent., were under treatment for water.

These conditions apply approximately to the wells operated by other companies in the same locality, and in dealing with the gas problem this water menace must never be disregarded nor neglected. A reference to the history of what is known as the Essex gas field[2] will demonstrate clearly that unless precautionary measures are taken to prevent the remaining gas content of the Tilbury field being drawn from the rock too rapidly, there is every reason to expect it will suffer a similar fate to that which befel the Essex field, which though only about five square miles in area, produced abundantly for about twelve years, after which the pressures decreased suddenly, and the field became exhausted three years later. That the waterflow in a gas well is controlled largely by the pressure maintained in the well, also by rate of flow at which gas is withdrawn, is shown by the chart on page 22, which records the water-pumping operations of two gas companies in adjacent localities in the Tilbury field.

It will be noted that the record is based upon the average number of gallons of water pumped per well per day.

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[1] The average yearly pressures of a prominent gas field in Alberta demonstrate that the depletion of gas fields is not confined to Ontario alone.

Year	1912	1913	1914	1915	1916	1917	1918	1919
Lbs.	744	723	660	641	629	446	312	251

[2] Ontario Bureau Mines, Vol. XXVIII, 1919, Pt. 1, p. 214.

The lower curve indicates that the water production during the months of September, October, November and December, 1919, and the same months of 1920, showed about the same range of variation; also that during the two cold months of January and February, 1920, it remained about even, then dropped quite suddenly, gradually increasing until it took a sudden rise, consistent with the increasing cold weather during November, December, and January, 1921. The general trend of the curve indicates that during the colder months of the year, when the pull is greater upon the output of the wells and pressures are low, the water-flow is heavy, and that in warm months, when consumption is at a minimum and pressure con-

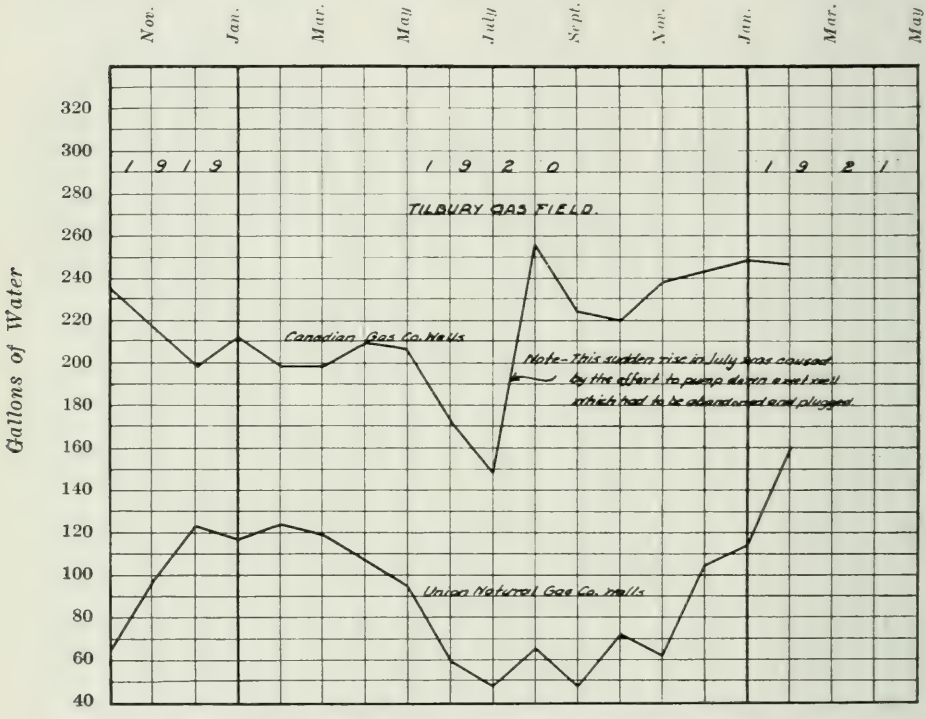


Chart illustrating effect of water pumping by two gas companies in the Tilbury field.

sequently at a maximum, the quantity of water is negligible. The sudden rise in June and July in the upper curve of the chart is explained by the fact that the wells in this field were under special treatment for water, and the condition of one well, which was flooded, and could not be pumped out, is indicated on the curve. This well was abandoned and plugged, otherwise the trend of the two curves is very similar.

The present cost of equipping a gas well with a gas-power water-pumping unit is approximately as follows:

Unit Pumping Outfit	$ 621.00
Tubing, Rods, etc.	684.00
Shed, Foundation and Labor	150.00
Total	$1,455.00

The foregoing remarks have dealt largely with removing water from wells, but special attention has been given by the Department to "malignant wells;" the finding of those abandoned years ago and lost; the detecting of defective casing and

the proper plugging of all kinds of abandoned wells. So many conditions exist whereby production from gas wells and fields is seriously retarded and diminished by the unrestrained flow of water from well to well, that the full importance of these defects, (as shown in illustrations 1 to 10) can hardly be over-estimated. On receipt of a complaint of water-damage or the intended plugging of an abandoned well, a competent inspector is immediately put in touch with the case, and the matter investigated and remedied under his supervision.

The following illustrations (Figures 1 to 10) are reproduced through the courtesy of the State Oil and Gas Supervisor of California. They are useful as showing what is required in dealing with typical cases. There are many other complications due to geological and mechanical conditions that could be illustrated, but these are sufficient to demonstrate the possibilities of damage due to neglected defects.

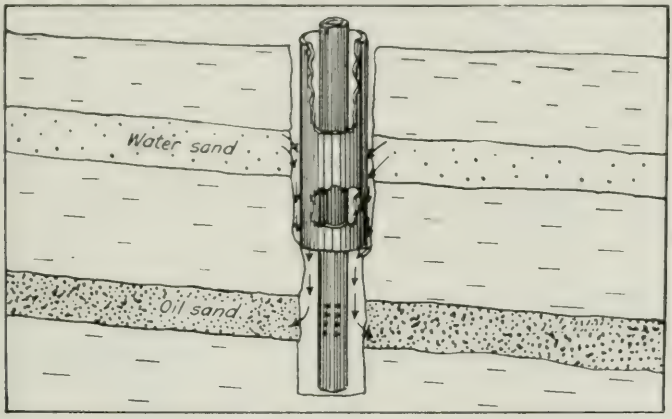


Fig. 1. Sketch showing entrance of water into oil sand due to imperfect seating of casing, and to lack of cement around bottom of outer casing.

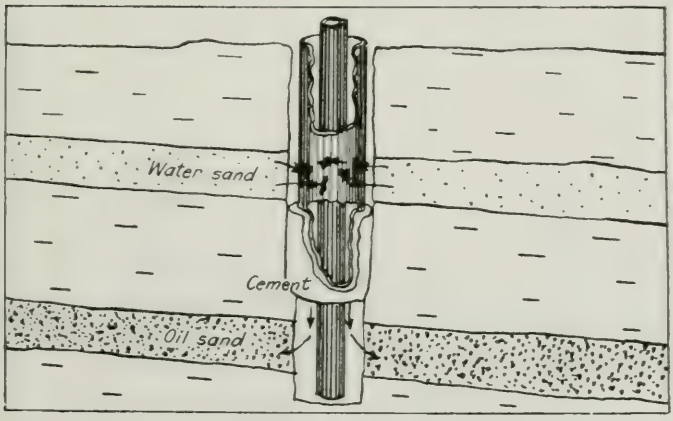


Fig. 2. Sketch showing entrance of water due to holes eaten in casing by chemical action.

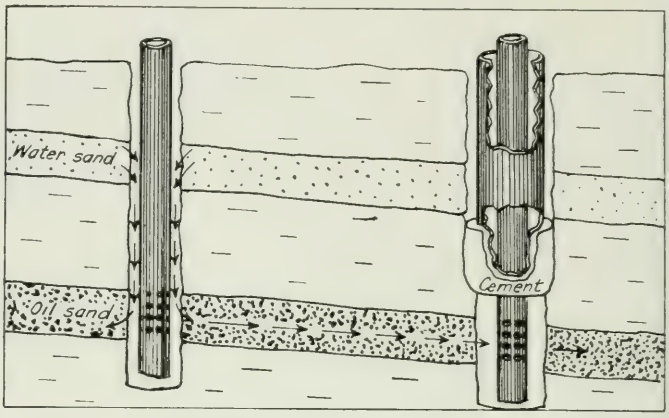


Fig. 3. Sketch showing entrance of water into oil sand and its migration to a properly drilled well due to use of only one string of casing in first well.

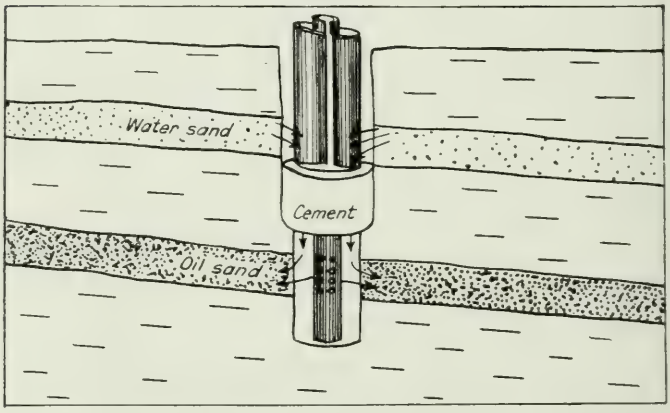


Fig. 4. Sketch showing entrance of water into oil sand due to collapse of casing.

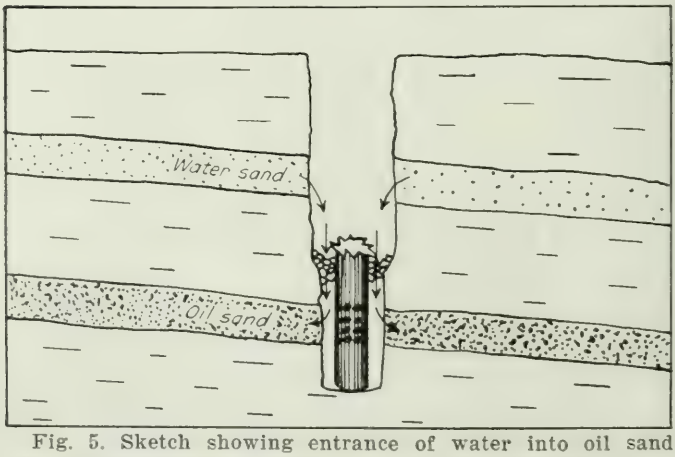


Fig. 5. Sketch showing entrance of water into oil sand due to withdrawal of casing from an abandoned well without placing a plug between oil and water sands.

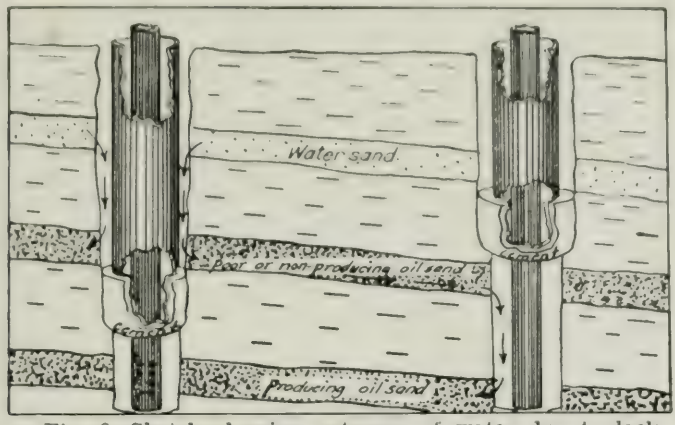


Fig. 6. Sketch showing entrance of water due to lack of uniformity of shut-off below water sands when two wells penetrated the same strata. If there were only one well, either one would probably be in good condition.

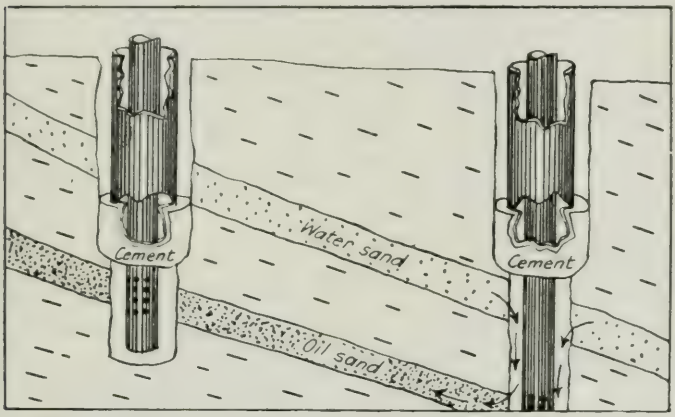


Fig. 7. Sketch showing entrance of water due to fact that shut-off was made at the same depth in two wells without considering the geological fact that strata most frequently do not lie parallel to ground surface.

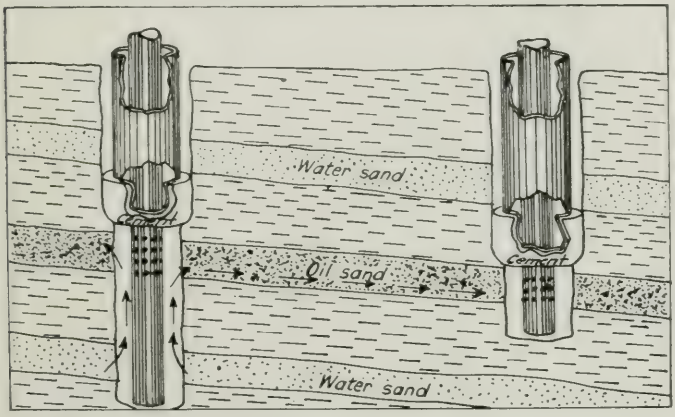


Fig. 8. Sketch showing entrance of water into a properly drilled well due to the fact that another well drilled into a water bearing sand below the oil sand, but did not plug the lower portion of the well.

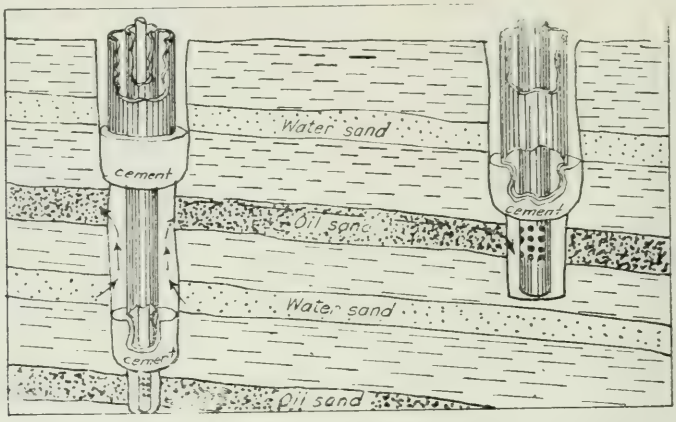


Fig. 9. Sketch showing entrance of water into a properly drilled well because a neighbouring well entered a deeper oil sand without an extra string of casing being inserted to protect the first sand.

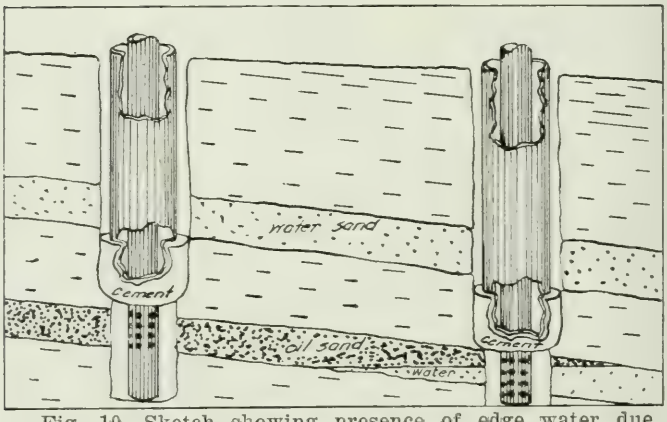
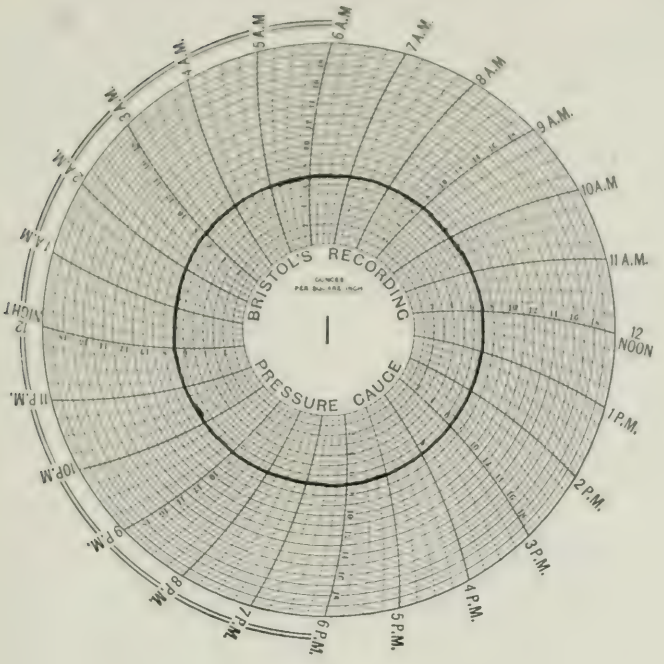
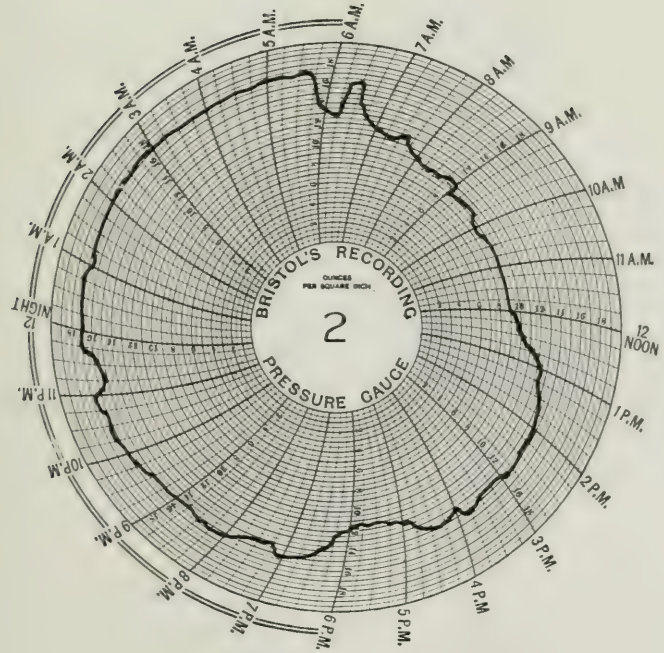


Fig. 10. Sketch showing presence of edge water due to a natural condition. Most oil sands when followed far enough down the dip are found to contain only water. As oil is removed from above, water follows it up along the stratum.

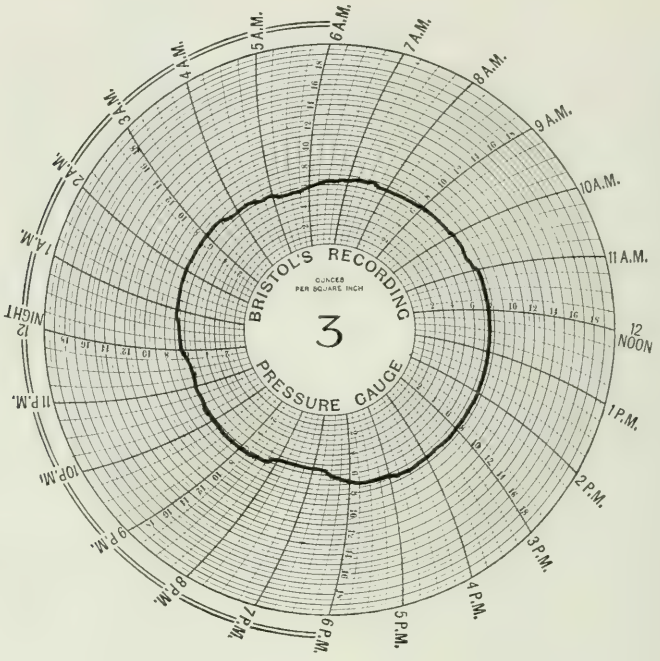
Distribution Problems

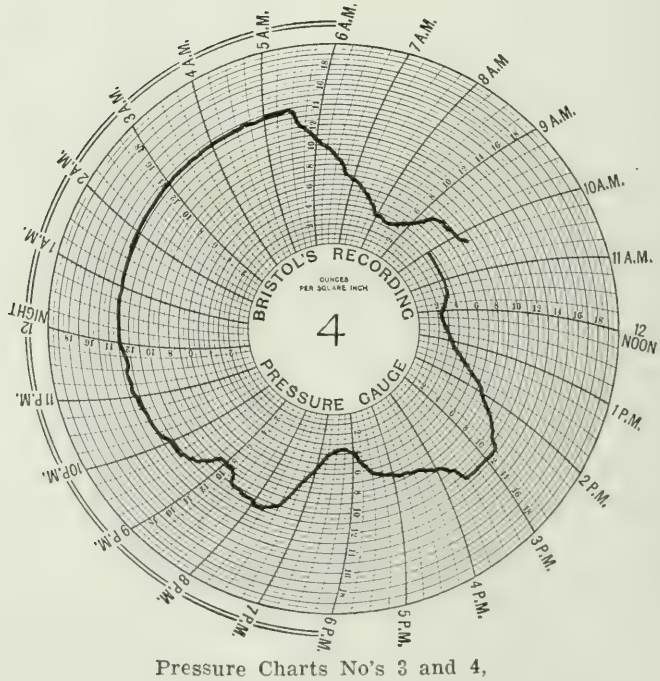
The problems connected with the distribution of the product of the Ontario gas fields are very confusing to that portion of the population who are consumers of this valuable fuel. It is difficult, for instance, to understand why a shortage, causing general inconvenience and discomfort, should ever occur when, for nearly nine months out of the year, there is ample gas for everyone and for all purposes. The "peak demand" can be more easily understood by referring to chart on page 6, which shows how the consumption rises to the highest levels in the coldest months. This only gives a general idea of the situation, because the real "peak demand" coming on cold days, the sudden pull upon all the supply lines, occurring at once, is far greater than the delivery from the wells: the result is the partial emptying of pipelines and reduction of pressure. The daily and hourly "peak" is the real terror of all gas distributors and producers.





Pressure Charts No's 1 and 2.

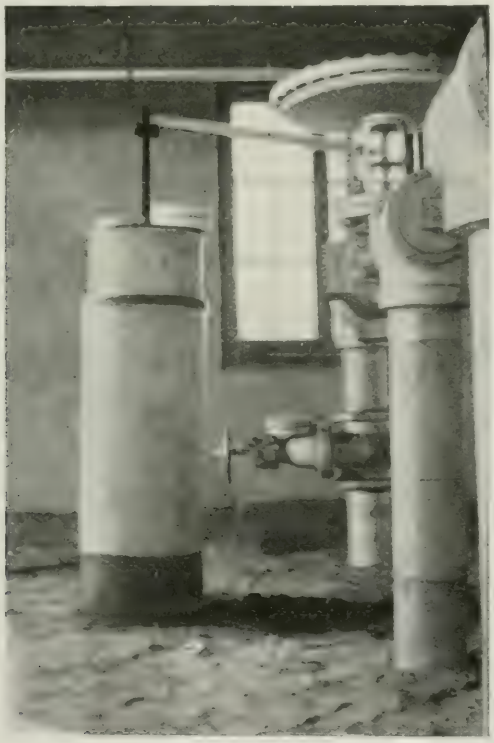




Pressure Charts No's 3 and 4,

Pressure Chart No. 2 was taken from a recording pressure gauge before the gasometer attachment was installed and Pressure Chart No. 1 shows the reading after the installation. Pressure charts 4 and 3 were both taken from another regulator, before and after the installation of a gasometer respectively, and show similar results. This is an important innovation, and a very welcome addition to the distributing equipment because by the use of the gasometer attachment, great improvement is effected in the service to the consumer, who receives a more even pressure.

Many of the troubles caused by the effort to distribute natural gas under varying pressures are very real, and occasion the gas operator considerable concern. Frequent changes of pressure occurring in the distribution of Tilbury gas throw a heavy responsibility upon the regulators. These instruments are affected by the corrosive elements in the gas, and require constant attention. The Department has watched with interest the installation of a gasometer attachment, recently applied to low pressure regulators.



Gasometer attachment to low pressure regulator.

Field Operations

Ninety-four wells were drilled in 1920, most of them in the counties of Haldimond, Welland, Norfolk and Kent. Of these new wells, 73 were producers, and 21 or 22.3 per cent., were non-producers The 73 producers showed a total open flow measurement of 9,203,000 cubic feet. Following is a list of the new wells and the individuals or companies for whom they were sunk.

Gas Wells Drilled in 1920

Owner	Locality				Gas or Oil	Production per day,[1] Cubic Feet	Date Completed
	Lot, Concession		Township	County			
Richmond Gas Co.	1	4	Bayham	Elgin	Gas	300,000	Aug. 16th
Dominion Natural Gas Co.....	120	7	Bayham	Elgin	"	Dry	May 10th
"	18	2	"	"	"	39,000	Dec. 14th
Glenwood Natural Gas Co....	21	8	Aldboro	"	"	Dry	Jan. 12th
Glenwood Natural Gas Co....	14	1	Mersea	Essex	"	Dry	June 21st
Dominion Natural Gas Co...	Dochstader Farm		Canboro	Haldimand	"	46,000	March 24th
"	C. Kuren Farm		"	"	"	21,000	June 9th
Oswego Gas Co.....	5	1	"	"	"	32,000	July 17th
Dominion Natural Gas Co....	P. Kuren Farm		"	"	"	64,000	July 6th
"	W. Clifford Farm		"	"	"	70,000	July 28th
"	W. Clifford Farm		"	"	"	75,000	Aug. 13th
"	W. Crumb Farm		"	"	"	45,000	Sept. 1st
"	W. Crumb Farm		"	"	"	68,000	Nov. 19th
"	E. Crumb Farm		"	"	"	67,000	Sept. 24th
Dominion Natural Gas Co....	S. Crosby Farm		Canboro	Haldimand	"	157,000	Oct. 12th
"	S. Crosby Farm		"	"	"	105,000	Oct. 29th
"	4	3	"	"	"	Dry	Dec. 7th
"	8	3	"	"	"	97,000	Dec. 30th
Lalor, F. R...	7	1	Moulton	"	"	Est. 80,000	July 27th
Lalor, F. R...	7	1	"	"	"	" 70,000	Sept. 13th
Maple Leaf Oil & Gas Co.	15	2	"	"	"	25,000	May 15th
"	13	3	"	"	"	200,000	July 30th
"	13	3	"	"	"	175,000	Sept. 9th
"	9	3	"	"	"	250,000	Oct. 20th
"	10	2	"	"	"	200,000	Dec. 21st
Midfield Gas Co.....	53	1	North Cayuga	"	"	6,000	Feb. 9th
"	53	1	"	"	"	80,000	Mar. 25th
Oswego Gas Co.....	5	Stage Road	"	"	"	156,000	Aug. 20th
"	4	"	"	"	"	97,000	Sept. 23rd
Azoff Gas Co.	3	3	"	"	"	39,000	Nov. 18th
"	1	1	"	"	"	Dry	Dec. 31st

[1] It should be noted that the volume of gas given here is "open flow" and not the actual quantity of serviceable gas "in the line."

Gas Wells Drilled in 1920.—*Continued*

Owner	Locality				Gas or Oil	Production per day, Cubic Feet	Date Completed
	Lot.	Concession	Township	County			
United Gas Companies...	4	1	North Cayuga	Haldimand	Gas	585,000	July 15th
"	4	1	"	"	"	382,000	Aug. 4th
"	4	1	"	"	"	Dry	Oct. 27th
"	4	1	"	"	"	78,000	Nov. 17th
Midfield Gas Co.....	53	1	Oneida	"	"	74,000	May 7th
"	54	Town Line	"	"	"	75,000	June 26th
"	53	1	"	"	"	50,000	Aug. 11th
Dominion Natural Gas Co.....	61	4	Oneida	"	"	111,000	Oct. 13th
"	68	River Road	"	"	"	85,000	Dec. 4th.
"	65	"	"	"	"	171,000	Dec. 13th
Sterling Natural Gas Co.....	17	1	Sherbrooke	"	"	200,000	Mar. 26th
"	17	1	"	"	"	Dry	May 31st
United Gas Companies...	3	1	Seneca	"	"	231,000	Sept. 21st
"	3	1	"	"	"	45,000	Oct. 6th
Dominion Natural Gas Co.....	F. Langford Farm		"	"	"	21,000	Jan. 10th
"	B.	2	"	"	"	34,000	Jan. 24th
"	R. Young Farm		"	"	"	Dry	Apr. 2nd
"	N. Kelly Farm		"	"	"	87,000	Aug. 21st
"	N. Kelly Farm		"	"	"	75,000	Apl. 4th
"	Shipway Farm		"	"	"	110,000	Dec. 17th
Port Colborne -Welland Gas Co.....	S. Bradt Farm		"	"	"	87,000	Oct. 11th
"	B. Hanna Farm		"	"	"	367,000	Dec. 4th
Petrol Oil & Gas Co.....	1	Front	Dover	Kent	"	Est. 500,000	May 25th
"	1	"	"	"	"	Dry	Dec. 4th
B. Jasperson.	15	13	East Tilbury	"	"	70,000	Mar. 17th
Glenwood Natural Gas Co.....	13	Middle Road	"	"	"	700,000	May 15th
"	13	"	"	"	"	225,000	Aug. 11th
"	14	"	"	"	"	Dry	Oct. 28th
Glenwood Natural Gas Co.....	3	1	Raleigh	"	"	45,000	Dec. 31st
"	191	Talbot Road	Romney	"	"	Dry	Mar. 13th
"	25	2	"	"	"	Dry	Aug. 16th
B. Jasperson.	28	2	"	"	"	80,000	Nov. 19th
Chippewa Oil & Gas Co....	3	3	Caistor	Lincoln	"	97,000	Jan. 7th
Castle Oil & Gas Co.....	25	5	Euphemia	Lambton	"	Est. 80,000	Mar. 2nd
"	27	5	"	"	"	Dry	July 6th
"	27	5	"	"	"	Dry	July 7th

Gas Wells Drilled in 1920.—*Continued*

Owner	Locality				Gas or Oil	Production per day, Cubic Feet	Date Completed
	Lot.	Concession	Township	County			
Progressive Natural Gas Co.	4	3	North Dorchester	Middlesex	Gas	Dry	May 14th
"	4	3	"	"	"	"	June 23rd
"	4	3	"	"	"	250,000	Dec. 14th
Dominion Natural Gas Co.	Long Point		N.Walsingham	Norfolk	"	150,000	Mar. 6th
"	6	Front	Woodhouse	"	"	252,000	May 20th
"	35	3	Middleton	"	"	42,000	June 2nd
"	4	3	Houghton	"	"	90,000	July 10th
Dominion Natural Gas Co.	43	2	Middleton	Norfolk	"	131,000	July 22nd
"	4	N. Talbot Road	"	"	"	Dry	Nov. 29th
"	6	Front	Woodhouse	"	"	140,000	July 31st
"	Niagara & Erie Land Co.		NorthWalsingham	"	"	68,000	Aug. 19th
"	"		"	"	"	80,000	Sept. 3rd
"	"		"	"	"	39,000	Oct. 21st
"	A. Keable Farm		"	"	"	Dry	Nov. 22nd
"	21	14	"	"	"	83,000	Dec. 11th
"	5	Front	Woodhouse	"	"	37,000	Oct. 2nd
"	6	"	"	"	"	42,000	Dec. 7th
Dominion Natural Gas Co.	2	4	Binbrook	Wentworth	"	40,000	Oct. 30th
"	1	1	"	"	"	90,000	Dec. 23rd
Sparham, A.F	11	8	Glanford	"	"	Est. 50,000	Dec. 22nd
Provinc'l Natural Gas Co.	26	2	Bertie	Welland	"	40,000	June 21st
"	10	2	"	"	"	Dry	May 11th
"	10	5	"	"	"	Est. 85,000	June 25th
"	11	13	"	"	"	40,000	Aug. 15th
"	8	13	"	"	"	225,000	Oct. 21st
"	9	13	"	"	"	Dry	Nov. 15th
"	11	5	Willoughby	"	"	Dry	Dec. 16th

Summary of New Wells.

	No.
Elgin County	4
Essex County	1
Haldimand County	48
Kent County	10
Lincoln County	1
Lambton County	3
Middlesex County	3
Norfolk	14
Wentworth County	3
Welland County	7
Total	94

The number of wells drilled in 1920 was up to the average of the two previous years, but much less than the average for 1916 and 1917. The quantity of new gas brought in was considerably less than in 1919. As compared with last year's operations, there is a falling off indicated in the amount of gas recovered as shown by the following table:—

TABLE XI.—DRILLING OPERATIONS FOR FIVE YEARS

YEAR	NEW WELLS	PRODUCERS	NON-PRODUCERS		DAILY OPEN-FLOW PRODUCTION, CU. FT.
			NUMBER	PER CENT	
1916	173	135	38 or	22.0	
1917	173	121	52 or	30.0	
1918	97	66	31 or	32.0	
1919	93	77	16 or	17.2	20,000,000
1920	94	73	21 or	22.3	9,203,000

It is safe to assume that, as most of the drilling was done in the older gas territory, the results could hardly be expected to show a gain over the previous year. When more active drilling operations are carried on in new or "wild cat" districts, the productivity of each new well should make a very much more encouraging showing.

The drilling of new wells is the most important part of the gas enterprise; without a persistent and courageous policy of development, no gas field can be made to survive. The drill must be kept active if new gas is to be obtained to replace that drawn from the fields from year to year. This means that sufficient money must be derived from the sale of gas to take care of this work in the face of 22.3 per cent. "dry holes." These comparisons show clearly that the natural gas rates have a direct bearing upon the kind of service the public may expect if development work is not encouraged.

The importance of caring for the "dead" wells has been referred to elsewhere in this report. These operations for the year included the plugging of 45 old wells and the 21 new non-producers reported as new drilling.

Drillers' Logs

The following "drillers' logs" are reproduced here because it is found that such logs are useful to those engaged in active field operations, and are readily understood by the field men themselves, who also can have access to the printed reports without being obliged to resort to office records merely.

Since taking charge of natural gas affairs, the Ontario Department of Mines has collected and recorded in the Gas Commissioner's office about 200 well logs. As a large portion of the information from which the early geological data was compiled had to be obtained from a few recorded logs and from the memory of those who did the actual drilling, these records being recent in date and made while fresh in the minds of the drillers, are bound to have considerable value in studying the stratigrophy of known or possible gas areas.

It would have a very direct bearing on the development of the known gas fields and the location of further supplies of gas either in areas as yet unrecognized, or in more deeply seated rock formations, if greater attention could be paid to the investigation of the structural and stratigraphical geology of south-western Ontario.

It is to be hoped that the Ontario Department of Mines may make provision for this work at an early date, and arrange to obtain the required data direct. This is the only way that reliable logs of all borings can be obtained. The progress of each drill-hole must be watched from day to day and measurements and cuttings obtained by an official who will have access to all borings during their progress. The close study of the formations favorable to deposits of gas and petroleum and the preparation of carefully prepared reference maps showing the levels, contours and other structural details, are of the highest importance and value to the development of all the gas and petroleum resources of the Province. The same careful attention could at the same time be given to the conditions affecting other resources such as salt, gypsum, water supplies, etc. Such information properly worked up and tabulated would enable the development of further gas supplies to proceed with a minimum of risk.

Log No. 1.

Lot.	Concession.	Township.	County.
13	Middle road South	Tilbury East.	Kent.

Estimated Production 700,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Clay	145 ft.	145 ft.
Limestone	20	165
Lime	10	175
Grey Lime	125	300
Dark Grey Lime	290	590
Grey Sharp Sand	45	635
Grey Lime	75	710
Light Grey Lime	90	800
First Gas	390	1190
Slate	40	1230
Grey Lime	120	1350
Gas		
Total Depth	1350 feet	

Log No 2.

Lot.	Concession.	Township.	County.
191	Talbot road.	Romney.	Kent.

Dry Hole; Plugged.

Formation	Thickness of Formation	Total Depth
Clay	160 ft.	160 ft.
Gravel	15	175
Lime	25	200
Gravel and Soap	50	250
Grey Lime	240	490
Sharp Sand	70	560
Grey Lime	190	750
Slate	190	940
Lime	310	1250
Showing of Gas	20	1270
Gas Sand	50	1320
Lime	40	1360
Salt Sand	140	1500
Red Medina	30	1530
White Medina	80	1610
Total Depth	1610 feet	

Log No 3.

Lot.	Concession.	Township.	County.
13	Middle Road South	Tilbury East.	Kent

Estimated Production. 225,000 cubic feet

Formation	Thickness of Formation	Total Depth
Clay	105 ft.	105 ft.
Sand & Gravel	40	145
Soap Stone	65	210
Grey Lime	260	470
Sharp Sand	170	640
Grey Lime	410	1050
Slate	130	1180
Grey Lime	185	1365
Total Depth	1365 feet	

Log No 4.

Lot.	Concession.	Township.	County.
Long Point Company.		South Walsingham	Norfolk.

Estimated Production 150,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Grey Medina		190 ft.
Flint		348
Lime		545
Niagara		990
Slate		1225
Red Medina		1360
White Medina		1467
Red Shale		1482
Total Depth	1482 feet	

Log No 5.

Lot.	Concession.	Township.	County.
4	III.	Houghton	Norfolk.

Estimated Production 314,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Surface	294 ft.	294 ft.
Brown Lime	206	500
Flint	150	650
White Lime	450	1100
Niagara	235	1335
Slate	69	1404
Clinton	20	1424
Red Medina	15	1439
White Medina	24	1463
Total Depth	1463 feet	

Log No 6.

Lot.	Concession.	Township.	County
35	III.	Middleton	Norfolk.

Estimated Production 42,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Surface	218 ft.	218 ft.
Lime	151	369
Flint	48	417
Sharp Sand	80	497
Hard Lime	50	547
Lime & Shale	81	628
Brown Lime	98	726
Hard Lime	148	874
Niagara Lime	243	1117
Shale	43	1160
Clinton	30	1190
Red Medina	5	1195
Grey Shale	35	1230
Total Depth	1230 feet	

Log No 7.

Lot.	Concession.	Township.	County.
43	II.	Middleton	Norfolk.

Estimated Production 131,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Surface		184 ft.
Lime		315
Flint		380
Sharp Sand		435
Hard Lime		493
Lime & Shale		601
Brown Lime		696
Hard Lime		840
Niagara Lime		1100
Shale		1108
Climton		1135
Red Medina		1140
Shale		1177
Total Depth	1177 Feet	

Log No 8.

Lot.	Concession.	Township.	County.
Niagara & Erie Land Co.		N. Walsingham	Norfolk.

Estimated Production 80,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Lime		219 ft.
Hard Lime		498
Lime & Shale		548
Niagara Lime		873
Red Medina		1195
Grey Shale		1200
Total Depth	1200 Feet	

Log No 9.

Lot.	Concession.	Township.	County.
Niagara & Erie Land Co		N. Walsingham	Norfolk.

Estimated Production 68,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Lime		202 ft.
Hard Lime		492
Lime & Shale		543
Niagara Lime		870
Red Medina		1193
Grey Shale		1198
Total Depth	1198 Feet	

Log No 10.

Lot.	Concession.	Township.	County.
5	Broken Front	Woodhouse	Norfolk.

Estimated Production 37,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Flint		129 ft.
Lime & Shale		375
Niagara Lime		674
Shale		960
Red Medima		1040
White Medina		1145
Red Shale		1151
Total Depth	1151 Feet.	

Log No 11.

Lot.	Concession.	Township.	County.
Peter Boughner farm.		Woodhouse	Norfolk.

Estimated Production 252,00 cubic feet.

Formation	Thickness of Formation	Total Depth
Flint		117 ft.
Lime & Shale		375
Niagara Lime		670
Shale		964
Red Medina		1036
White Medina		1132
Red Shale		1152
Total Depth	1152 Feet.	

Log No 12.

Lot.	Concession.	Township.	County.
Peter Boughner farm		Woodhouse	Norfolk

Estimated Propuction 140,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Flint		95
Lime & Shale		342
Niagara Lime		642
Clinton		990
Red Medina		1018
White Medina		1113
Red Shale		1133
Total Depth	1133 Feet.	

Log No 13.

Lot.	Concession.	Township.	County.
14	I.	Mersea	Essex

Dry Hole. Plugged.

Formation	Thickness of Formation	Total Depth
Clay	82 ft.	
Clay & Gravel	70	152 ft.
Lime	18	170
Lime Grey	50	220
Lime Brown	70	290
Lime Grey	70	360
Lime Light Grey	65	425
Lime Dark Grey	50	475
Lime Light Brown	50	525
Lime Dark Grey	117	642
Lime Brown	18	660
Lime Grey	50	710
Lime Dark Grey	60	770
Slate	230	1000
Total Depth	1000 Feet.	

Log No 14.

Lot.	Concession.	Township.	County.
13	III.	Moulton	Haldimand

Estimated Production 150,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Surface	100 ft.	
Brown Lime	125	225 ft.
Niagara	210	435
Casing Shale	50	485
Clinton	30	515
Red Medina	40	555
Blue Shale	60	615
White Medina	10	625
Red Shale	50	675
Total Depth	675 Feet.	

Log No. 15.

Lot.	Concession.	Township.	County.
15	II.	Moulton	Haldimand.

Estimated Production, 25,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Surface	94 ft.	
Brown Lime	140	234 ft.
Niagara	201	435
Casing Shale	40	475
Clinton	30	505
Red Medina	40	545
Blue Shale	60	605
White Medina	12	617
Red Shale	110	727
Total Depth	727 Feet.	

Log No. 16

Lot.	Concession.	Township.	County.
13	III.	Moulton	Haldimand.

Estimated Production, 200,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Surface	110 ft.	
Brown Lime	120	230 ft.
Niagara	200	430
Casing Shale	55	485
Clinton	28	513
Red Medina	42	555
Blue Shale	63	618
White Medina	12	630
Red Shale	53	683
Total Depth	683 Feet.	

Log No. 17.

Lot.	Concession.	Township.	County.
9	III.	Moulton	Haldimand.

Estimated Productions, 250,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Surface	91 ft.	
Lime	130	221 ft.
Niagara	214	435
Casing Shale	52	487
Clinton	35	522
Red Medina	40	562
Blue Shale	58	620
White Medina	12	632
Red Shale	50	682
Total Depth	682 Feet.	

Log No. 18.

Lot.	Concession.	Township.	County.
10	II.	Moulton	Haldimand.

Estimated Productions, 200,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Surface	91 ft.	
Lime	132	223 ft.
Niagara	205	428
Casing Shale	60	488
Clinton	35	523
Red Medina	35	558
Blue Shale	54	612
White Medina	15	627
Red Shale	55	682
Total Depth	682 Feet.	

Log No. 19.

Lot.	Concession.	Township.	County.
S½ 54	Town Line road	Oneida	Haldimand

Estimated Productions, 75,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Clay	10 ft.	
Flint	21	31 ft.
Grey Lime	61	92
Shale	88	180
Shale & Limestone	127	407
Guelph Lime	100	280
Niagara Limestone	249	656
Casing Shale	15	671
Grey Shale	48	719
Clinton Sand No. 1	26	745
Red Medina Sand No. 2	43	788
Blue Shale	50	838
White Medina Sand No. 3	10	848
Red Shale	29	877
Total Depth	877 Feet.	

Log No. 20.

Lot.	Concession.	Township.	County.
S½ 54	Stage road	N. Cayuga	Haldimand

Estimated Productions, 97,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Surface	43 ft.	
Shale	152	195 ft.
Niagara	200	395
White Lime	55	450
Shale	32	482
Clinton	28	510
Red Medina	38	548
Blue Shale	59	607
White Medina	15	622
Red Shale	28	650
Total Depth	650 Feet.	

Log No. 21.

Lot.	Concession.	Township.	County.
N½ 53	1.	Oneida	Haldimand

Estimated Production, 50,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Clay	7 ft.	
Shelly, Rock & Flint	25	32 ft.
Grey Lime	48	80
Shale	105	185
Guelph Lime	90	275
Shale & Limestone	125	400
Niagara Lime	246	646
Casing Shale	44	690
Shale	7	697
Clinton Sand No. 1	30	727
Red Medina Sand No. 2	42	769
Blue Shale	41	810
White Medina No. 3	12	822
Red Shale	40	862
Total Depth	862 Feet.	

Log No. 22.

Lot.	Concession.	Township.	County.
3		N. Cayuga	Haldimand.

Estimated Production, 39,400 cubic feet.

Formation	Thickness of Formation	Total Depth
Surface	38	
Shale	142	180 ft.
Niagara	200	380
White Lime	51	431
Shale	34	465
Clinton	29	494
Red Medina	35	529
Blue Shale	60	589
White Medina	13	602
Red Shale	2	604
Total Depth	604 Feet.	

Log No. 23.

Lot.	Concession.	Township.	County.
1		N. Cayuga	Haldimand.

Dry Hole; Plugged.

Formation	Thickness of Formation	Total Depth
Surface	47	
Shale	138	185 ft.
Niagara	200	385
White Lime	50	435
Shale	30	465
Clinton	25	490
Red Medina	37	527
Blue Shale	61	588
White Medina	13	601
Red Shale	4	605
Total Depth	605 Feet.	

Log No. 24.

Lot.	Concession.	Township.	County.
61	IV.	Oneida	Haldimand.

Estimated Production 111,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Clay	67	
Shale & Limestone	168	235 ft.
Niagara Lime	227	462
Casing Shale	9	471
Grey Shale	39	510
Clinton Sand No. 1	25	535
Red Medina No. 2	44	579
Blue Shale	50	629
White Medina Sand No. 3	18	647
Red Shale	50	697
Total Depth	697 Feet.	

Log No. 25.

Lot.	Concession.	Township.	County.
68	River Range	Oneida	Haldimand

Estimated Production 85,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Clay or Surface	18	
Gypsum & Shale	21	39 ft.
Shale & Limestone	182	221
Niagara Lime	229	450
Casing Shale	10	460
Grey Shale	37	497
Clinton Sand No. 1	31	528
Red Medina Sand No. 2	46	574
Blue Shale	45	619
White Medina Sand No. 3	16	635
Red Shale	50	685
Total Depth	685 Feet.	

Log No. 26.

Lot.	Concession.	Township.	County.
65	River Range	Oneida	Haldimand.

Estimated Production 171,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Surface Clay	25	
Guelph Lime & Shale	194	219 ft.
Niagara Lime	211	430
Casing Shale	17	447
Grey Shale	36	483
Clinton Sand No. 1	22	505
Red Medina No. 2	46	551
Blue Shale	46	597
White Medina Sand No.3	23	620
Red Shale	50	670
Total Depth	670 Feet.	

Log No. 27.

Lot.	Concession.	Township.	County.
S½ 53	I.	Oneida	Haldimand.

Mercury Guage Reading 74,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Clay	11	
Flint	18	29 ft.
Grey Lime	61	90
Shale	95	185
Guelph Lime	100	285
Shale & Limestone	124	409
Niagara Limestone	235	644
Casing Shale	21	665
Grey Shale	41	706
Clinton Sand	36	742
Red Medina Sand	35	777
Blue Shale	45	822
White Medina	12	834
Red Shale	42	876
Total Depth	876 Feet.	

Log No. 28.

Lot.	Concession.	Townnship.	County.
17	I.	Sherbrooke	Haldimand.

Estimated Production 200,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Surface	25	
Shale & Lime	485	510 ft.
Niagara	235	745
Shale	55	800
Clinton	30	830
Red Medina	45	875
Shale	52	927
White Medina	15	942
Red Shale	40	982
Total Depth	982 Feet.	

Log No. 29.

Lot.	Concession.	Township.	County.
17	I.	Sherbrooke	Haldimand

Dry Hole; Plugged.

Formation	Thickness of Formation	Total Depth
Surface	49	
Flint	85	134 ft.
Shale	81	215
Brown Lime	75	290
Shale & Lime	210	500
Niagara	180	680
Shale	55	735
Clinton Rock	30	765
Red Medina	40	805
Grey Shale	60	865
White Medina	17	882
Total Depth	882 Feet.	

Log No. 30

Lot.	Concession.	Township.	County.
53	I.	N. Cayuga	Haldimand.

Estimated Production, 6,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Clay	7	
Flint	38	45 ft.
Grey Lime	45	90
Shale	95	185
Guelph Lime	100	285
Shale & Limestone	147	432
Niagara	231	663
Grey Shale	61	724
Clinton Sand	27	751
Red Medina Sand	48	799
Blue Shale	50	849
White Medina Sand	15	864
Red Shale	30	894
Total Depth	894 Feet.	

Log No. 31.

Lot.	Concession.	Township.	County.
53	I.	N. Cayuga	Haldimand.

Formation	Thickness of Formation	Total Depth
Clay	15	
Flint	24	39 ft.
Grey Lime	51	90
Shale	95	185
Guelph Lime	108	293
Shale & Limestome	128	421
Niagara Lime	234	655
Casing Shale	54	709
Clinton Sand	28	737
Red Medina	48	785
Blue Shale	42	827
White Medina	14	841
Red Shale	46	887
Total Depth	887 Feet.	

Log No. 32.

Lot.	Concession.	Township.	County.
Florence Langford farm		Seneca	Haldimand

Estimated Production, 21,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Niagara		186
Red Medina		481
White Medina		562
Red Shale		584
Total Depth	584 Feet.	

Log No. 33.

Lot.	Concession.	Township.	County.
Robt. A. Young farm		Seneca	Haldimand.

Dry Hole; Plugged.

Formation	Thickness of Formation	Total Depth
Niagara		165
Red Medina		475
White Medina		571
Red Shale		584
Total Depth	584 Feet.	

Log No. 34.

Lot.	Concession.	Township.	County.
B	II.	Seneca	Haldimand.

Estimated Production, 34,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Niagara		115
Red Medina		444
White Medina		537
Red Shale		549
Total Depth	549 Feet.	

Log No. 35.

Lot.	Concession.	Township.	County.
5	I.	Canboro	Haldimand.

Estimated Production 32,320 cubic feet.

Formation	Thickness of Formation	Total Depth
Surface	53	
Shale	142	195 ft.
Niagara	200	395
White Lime	50	445
Shale	28	473
Clinton	28	501
Red Medina	38	539
Blue Shale	59	598
White Medina	18	616
Red Shale	26	642
Total Depth	642 Feet.	

Log No. 36.

Lot.	Concession.	Township.	County.
5	Stage Road	N. Cayuga	Haldimand.

Estimated Production 156,830 cubic feet.

Formation	Thickness of Formation	Total Depth
Surface	43	
Shale	150	193 ft.
Niagara	200	393
White Lime	55	448
Shale	35	483
Clinton	28	511
Red Medina	35	546
Blue Shale	60	606
White Medina	17	623
Red Shale	27	650
Total Depth	650 Feet.	

Log No. 37.

Lot.	Concession.	Township.	County.
Oliver Dochstader farm		Canboro	Haldimand

Formation	Thickness of Formation	Total Depth
Niagara		247
Shale		477
Red Medina		555
White Medina		642
Red Shale		667
Total Depth	667 Feet.	

Log No. 38.

Lot.	Concession.	Township.	County.
Chester VanKuren farm		Canboro	Haldimand.

Estimated Production 21,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Niagara		245
Slate		485
Red Medina		563
White Medina		653
Red Shale		675
Total Depth	675 Feet.	

Log No. 39

Lot.	Concession.	Township.	County.
Paul VanKuren farm		Canboro	Haldimand.

Estimated Production 64,000 cubic feet

Formation	Thickness of Formation	Total Depth
Niagara		245
Shale		485
Red Medina		563
White Medina		658
Red Shale		678
Total Depth	678 Feet	

Log No. 40.

Lot	Concession.	Township.	County.
Wm. Clifford farm		Canboro	Haldimand.

Estimated Production 70,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Niagara		246
Shale		486
Red Medina		569
White Medina		664
Red Shale		689
Total Depth	689 Feet.	

Log No. 41.

Lot.	Concession.	Township.	County.
Wm. Clifford farm		Canboro	Haldimand.

Estimated Production 75,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Niagara		246
Shale		486
Red Medina		563
White Medina		651
Red Shale		676
Total Depth	676 Feet.	

Log No. 42.

Lot.	Concession.	Township.	County
Walter Crumb farm		Canboro	Haldimand.

Estimated Production 45,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Niagara		236
Shale		480
Red Medina		577
White Medina		649
Red Shale		673
Total Depth	673 Feet.	

Log No. 43.

Lot.	Concession.	Township.	County.
Walter Crumb farm		Canboro	Haldimand

Estimated Production 68,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Niagara		230
Shale		465
Red Medina		548
White Medina		638
Red Shale		653
Total Depth	653 Feet.	

Log No. 44.

Lot.	Concession.	Township.	County.
Elias Crumb farm		Canboro	Haldimand.

Estimated Production, 67,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Niagara		238
Shale		472
Red Medina		550
White Medina		635
Red Shale		657
Total Depth	657 Feet.	

Log No. 45.

Lot.	Concession.	Township.	County.
S. J. Crosby farm		Canboro	Haldimand.

Estimated Production, 157,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Niagara		225
Shale		470
Red Medina		550
White Medina		645
Red Shale		660
Total Depth	660 Feet.	

Log No. 46.

Lot.	Concession.	Township.	County.
S. J. Crosby farm		Canboro	Haldimand.

Estimated Production, 105,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Niagara		220
Grey Shale		460
Red Medina		540
White Medina		623
Red Shale		648
Total Deqth	648 Feet.	

Log No. 47.

Lot.	Concession.	Township.	County.
3	III.	Caistor	Lincoln.

Estimated Production, 97,400 cubic feet.

Formation	Thickness of Formation	Total Depth
Surface	68	
Niagara	178	246 ft.
White Lime	60	306
Casing Shale	35	341
Clinton	25	366
Red Medina	38	404
Blue Shale	61	465
White Medina	18	483
Red Shale	30	513
Total Depth	513 Feet	

Log No. 48.

Lot.	Concession.	Township.	County.
26	II.	Bertie	Welland

Estimated Production, 40,000 cubic feet.

Formation	Thickness of Formation	Total Depth
To Top of Clinton	702	
Clinton	33	735 ft.
Red Medina	93	828
White Medina	18	846
Red Shale	41	887
Total Depth	887 Feet.	

Log No. 49

Lot.	Concession.	Township.	County.
1	I.	Binbrook	Wentworth

Estimated Production, 90,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Clay	74	
Brown Lime	76	150 ft.
Niagara	115	265
Casing Shale	40	305
Clinton	30	335
Red Medina	35	370
Blue Shale	55	425
White Medina	10	435
Red Shale	50	485
Total Depth	485 Feet.	

Log No. 50.

Lot.	Concession.	Township.	County
1-2	IV.	Binbrook	Wentworth

Estimated Production, 40,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Clay	69	
Brown Lime	76	145 ft.
Niagara	115	260
Casing Shale	40	300
Clinton Sand No. 1	30	330
Red Medina Sand No. 2	35	365
Blue Shale	54	419
White Medina Sand No. 3	8	427
Red Shale	50	477
Total Depth	477 Feet.	

Log No. 51.

Lot.	Concession.	Township.	County.
120	VII.	Bayham	Elgin

Dry Hole. Plugged.

Formation	Thickness of Formation	Total Depth
Brown Lime		150
Blue Lime		725
Niagara Lime		910
Shale		1165
Red Medina		1237
Total Depth	1237 Feet.	

Log No. 52.

Lot.	Concession.	Township.	County.
4	III.	N. Dorchester	Middlesex

Dry Hole. Plugged.

Formation	Thickness of Formation	Total Depth
Surface	110	
Grey Limestone	59	169 ft.
Brown Lime	361	530
White Limestone	43	573
Grey Limestone	147	720
Gypsum, Shale & Lime	59	779
Hard & Soft Shale	153	932
Guelph Lime Gas Sand	25	957
Shale	35	992
Hard Blue Shale	20	1012
Total Depth	1012 Feet.	

Log No. 53.

Lot.	Concession.	Township.	County.
4	III.	N. Dorchester	Middlesex

Dry Hole. Plugged.

Formation	Thickness of Formation	Total Depth
Clay Stones and Gravel	117	
Gray Lime	72	189 ft.
Brown Lime	341	530
White Lime .....p	43	573
Grey Lime	147	720
Gypsum	59	779
Shale	156	935
Guelph Lime	25	960
Shale	35	995
Guelph Lime	25	1020
Brown Lime	40	1060
Niagara	43	1103
Total Depth	1103 Feet.	

Log No. 54.

Lot.	Concession.	Township.	County.
4	III.	N. Dorchester	Middlesex.

Estimated Production 250,000 cubic feet.

Formation	Thickness of Formation	Total Depth
Clay & Stones	121	
Grey Lime	58	179 ft.
Brown Lime	358	537
White Lime	39	576
Grey Lime	149	725
Gypsum	57	782
Shale	163	945
Guelph Lime	25	970
Hard Shale	20	990
Total Depth	990 Feet.	

OIL FIELD OPERATIONS, 1920.

by

E. S. Estlin

The present oil-producing area of Ontario may be described as occupying all that portion of the southwestern peninsula south of a line drawn from Welland to Sarnia. Numerous fields of more or less importance, are scattered throughout this area, the chief of these being Petrolia, Oil Springs, Bothwell, township of Dover West, township of Tilbury East, Dutton, township of Sarnia, township of Mosa.

It is encouraging to note that the total production from these fields between the years 1919 and 1920 shows a smaller decline than the previous year. The 1919 production showed a falling off of 23.7 per cent. from 1918, but 1920 shows only a decline of 17.2 per cent.

Table I gives a comparison of the productions from the oil areas of Ontario which shows a small falling off in some individual fields and a considerable gain in Moore township. The Onondaga and Thamesfield fields showed an increase; Plympton remained about normal.

The gain in Moore township and the normal output of Plympton may be accounted for in part by the efforts of the Department in maintaining an energetic campaign of plugging and caring for abandoned and drowned-out wells, which if neglected, seriously interfere with the working of adjacent wells and, in some instances, drown them out. In cases where several wells are affected by fresh water invading the sands from an adjacent well, or from the surface, it takes careful attention to reveal the offending well and apply the correct remedy.

The production of the several fields during a period of five years was as follows:—

TABLE I.—CRUDE PETROLEUM PRODUCTION,[1] BY FIELDS, 1916-1920.

FIELD		1916	1917	1918	1919	1920
		Bbls.	Bbls.	Bbls.	Bbls.	Bbls.
Petrolia and Enniskillen	Lambton		74,267	65,467	70,087	65,082
Oil Springs	Lambton		46,902	44,671	45,245	39,388
Moore township	Lambton	142,208	6,282	6,367	4,029	7,036
Sarnia township	Lambton		4,494	3,438	4,259	3,495
Plympton township	Lambton		579	412	560	531
Bothwell		33,856	29,682	29,116	29,425	26,563
Dover, West	Tilbury	16,297	10,041	25,228	16,705	12,171
Tilbury, East	Tilbury				1,660	623
Dutton		2,852	2,941	1,875	1,272	837
Onondaga township		1,617	383	1,186	197	341
Belle River		46		447		
Mosa township			20,999	108,988	45,860	24,063
Thamesville			6,420	1,565	801	1,131
Total Production	Bbls	196,876	202,990	288,760	220,100	181,750
Value	$	387,846	475,000	781,097	632,789	724,145
Average Price per Bbl[2]		1.98	2.34	2.70½	2.87½	3.98½

The Bothwell, Oil Springs and Petrolia production was seriously affected by the hurricane which occurred on November 29th, 1919. This storm wrecked the three-pole derricks by the hundred, and damaged operating equipment to such an

[1] Figures supplied to the Ontario Department of Mines by J. C. Waddell, Supervisor of Petroleum Bounties, Petrolia.

[2] Producers of crude petroleum in Canada receive in addition a bounty under the "Petroleum Bounty Act" of 1½ cents per Imperial gallon or 52½ cents per barrel (35 gals.) from the Dominion Government.

extent that it was some months before normal operation was resumed. The larger operators suffered more severely because of the greater number of wells worked from central power plants, while smaller scattered groups of wells were more quickly restored to normal conditions.

Table II.—Production of Crude Petroleum in Ontario for 15 Years[1].

Year	Barrels (35 gals.)	Gallons (Imperial)	Year	Barrels (35 gals.)	Gallons (Imperial)
1906	588,962	19,928,322	1914	212,495	7,437,356
1907	779,876	27,621,851	1915	214,442	7,505,478
1908	528,959	18,479,547	1916	196,876	6,890,681
1909	420,660	14,723,105	1917	202,990	7,104,700
1910	314,410	11,004,357	1918	288,760	10,106,615
1911	288,634	10,102,081	1919	220,100	7,703,515
1912	240,935	8,432,730	1920	181,750	6,361,234
1913	226,165	7,915,761			

A typical oil field in Ontario.

Development Work and Prospecting

Some attention has been given to prospecting in Dufferin county, and drilling is now being done.

The formations consist of the Lorraine shales in the north-eastern part of the county, and in the southwestern, of the Guelph limestone, while intermediate is the Niagara escarpment, topped by the Niagara and Clinton limestones, and bordered below by the Medina shales. The geological sections will therefore range from the Guelph downward, according to the location of the well.[2]

Drilling operations are being carried on near Shelburne by the Canadian Oil Fields Limited, also by James Pickering and the Chamberlain Coal and Oil

[1] The above figures of production in barrels and the equivalent in Imperial gallons have been abstracted from the annual reports of the Ontario Department of Mines.

[2] Pet. & Nat. Gas Resources of Can., 1915, Dept. of Mines, Ottawa, Vol. II, Page 123.

Development Company. Several other persons and syndicates are making preparations to exploit this region.

The Valley Oil and Gas Company, are drilling in the Dundas valley.

In Raleigh township, the Ajax Gas and Oil Company have drilled five wells. While these borings were originally intended for determining the structure conditions, some very encouraging production was struck about one hundred feet in the Corniferous. The Eureka Oil and Gas Company have also drilled three producing wells in the same district. The Border Cities Oil and Gas Company are beginning a well close to those of the Companies mentioned.

In Dover township there has been considerable development work. Besides the five producing oil wells of the Union Natural Gas Company, the Petrol Oil and Gas Company have two producing wells which are holding their oil and gas production fairly steadily.

The Vacuum Oil and Gas Company are finishing a well in this township and have struck some production; the well is being shot and tubed, and the expectation is that the flow will increase when the well is completed.

The Thames Oil and Gas Company are also drilling in this vicinity.

The Inland Oil and Gas Company drilled four wells near Thamesville, the first two showing considerable production at first.

The Dover Oil Company report preparations under way for active development work in the Dover field, and on their several other properties in the older fields.

It is reasonable to expect something of a revival in the development of the petroleum deposits of Ontario, in the near future. New ground is being tested, and operators in the old producing oil fields are improving their equipment and giving their wells closer attention.

Hydro-electric power is being installed in many cases for pumping purposes and is found to be very satisfactory. The motors impart a steady motion, and require very little attention as compared with gas engine or steam power.

Table III.—Oil Wells Drilled and Plugged, in Ontario, 1920.

Township and Locality	Wells Drilled		Wells Plugged
	Producing	Dry	
Enniskillen		1	128
Oil Springs			25
Bothwell	1	1	7
Mosa			10
Thamesville			9
Dawn			10
Ekfrid		5	8
Brooke		2	2
Sarnia	2	1	27
Moore	3	2	16
Plympton		2	31
Adelaide	1	2	
West Williams		1	
Euphemia			2
Wallacetown			10
Total	7	17	285

It will be noted by examining Table III. that 128 wells were plugged in Enniskillen during the year. Notwithstanding this, the falling off in production was not very serious, being 5,000 barrels. This is of course, the largest and oldest field in

the Province, and the decline will probably be more than made up on account of the damage these wells were doing to the producers, up to the time they were plugged.

Plympton township comes next with 31 wells plugged, with practically no decline.

Sarnia township had 27 wells plugged, with a decline of only 165 barrels in the year.

In Oil Springs field 25 wells were plugged, and the production was well maintained.

This means that with 285 wells plugged in the year, the decline in production is being checked, and that the effort put forth in hunting for and treating the malignant wells that have been flooding whole areas for years, is well repaid.

The Table of Prices which follows was obtained through the courtesy of the Imperial Oil Company at Sarnia, and shows how the prices for Ontario crude varied throughout the year.

Table IV.—Canadian Crude Oil Prices in 1920, by Fields

	Jan. 1-Jan. 11	Jan. 12-Feb. 29	Mar. 1-Mar. 9	Mar. 10-Oct. 18	Oct. 19-Dec. 31
Price per Barrel at	$ c.	$ c.	$ c.	$ c.	$ c.
Petrolia	3.38	3.63	3.88	4.13	4.13
Bothwell	3.28	3.53	3.78	4.03	4.03
North Glencoe	3.28	3.53	3.78	4.03	4.03
Thamesville					4.03
Price Delivered, Sarnia or Petrolia.					
Onondaga	3.45	3.70	3.95	4.20	4.20
Dutton	3.45	3.70	3.95	4.20	4.32
Blakely	3.41	3.66	3.91	4.16	4.16
Bothwell	3.45	3.70	3.95	4.20	4.32
Oil Springs	3.45	3.70	3.95	4.20	4.20
Cainsville	3.45	3.70	3.95	4.20	4.20
Belle River	2.84	3.09	3.34	3.59	3.59
Fletcher	3.32	3.57	3.82	4.07	4.07
Glenwood	3.32	3.57	3.82	4.07	4.07
East Tilbury	3.32	3.57	3.82	4.07	4.07
Thamesville	3.45	3.70	3.95	4.20	4.32
Inwood	3.45	3.70	3.95	4.20	4.20
North Glencoe	3.45	3.70	3.95	4.20	4.32

Old and New Methods of Drilling for Oil.

The illustration showing the "kicker" or spring-pole method of drilling is of considerable interest. This photograph was taken 48 or 50 years ago during the drilling an oil well for the late John Kerr. The well was situated in the town of Petrolia. The persons seen in the photograph are said to have all passed away except the children. Reading from left to right they are Jim Love, and John Adams, (the "kickers" standing on the platform) then the driller standing close to the well is Wm. Stokes. The two children are said to be Kenneth and Mary Kerr, and John Kerr, the owner of the well, is standing on the extreme right. The horse was the sole means of pulling the tools and pipe and baling the well. By this means wells were put down about 350 feet and a 3-inch drill was generally used.

The old method of drilling—a "kicker" outfit

The modern method—a "standard" drilling rig.

This cut of an oil derrick is taken from a well in Dover township which is being "shot." At the moment of snapping the camera, about three hundred quarts of nitro-glycerine were exploding some 3,300 feet below, and the hazy appearance of the picture is probably due to the vibration of the derrick as the dislodged matter was hurled against it.

Refining Operations

Four refineries operated in the Province in 1920, as noted hereunder:

Petroleum Refineries

Company	Location of Refinery	Days Operated	Head Office Address
British American Oil Co., Ltd.	Toronto, Cherry St.	365	Toronto, Royal Bank Bldg.
Canadian Oil Companies, Limited	Petrolia	305	Petrolia.
Great Lakes Oil Refining Co. Ltd.	Wallaceburg	242	Toronto, 812 Excelsior Life Bldg.
Imperial Oil, Limited	Sarnia	366	Sarnia.

The following table, summarized from annual reports of the Ontario Department of Mines, shows refinery operations for the past five years:

Table V.—Statistics of Petroleum Refineries, 1916-1920.

Schedule	1916[1]	1917	1918	1919	1920
Crude petroleum production					
Imp. gals.	6,890,681	7,104,700	10,106,615	7,703,515	6,361,234
Value do $	387,846	475,000	781,097	632,789	724,145
American Crude, distilled,					
Imp. gals.	84,143,603	122,436,923	137,065,788	141,157,309	148,540,511
Value do $	4,932,598	9,236,033	12,612,882	12,486,174	20,102,784
Canadian Crude, distilled,					
Imp. gals.	7,437,382	8,122,062	9,513,222	7,693,385	6,402,118
Value do $	403,316	559,435	781,703	661,927	769,775
Per cent. of total	8.12	6.22	6.49	5.17	4.13
Products:					
Illuminating oil....Imp. gals.	25,405,296	40,195,774	36,211,715	34,800,233	33,897,891
Value do $	1,999,261	3,457,817	4,239,816	5,073,647	6,331,706
Lubricating oil.....Imp. gals.	10,373,508	12,288,466	12,595,305	12,501,385	13,804,074
Value do $	1,059,526	1,586,270	2,118,002	2,293,640	3,276,569
Benzine, Naphtha, Gasoline, ...Imp. Gals.	24,344,319	34,611,056	39,156,447	44,625,590	47,418,420
Value do $	5,077,314	8,292,828	10,244,328	11,677,077	14,485,935
Gas and Fuel oil, Tar. Imp. gals.	15,224,382	39,815,106	40,949,358	40,581,499	45,025,050
Value do $	686,800	2,671,414	2,943,503	2,265,457	5,486,636
Paraffin Wax and Candles..lbs.	8,834,945	12,649,553	13,650,128	10,903,202	10,398,127
Value do $	631,560	908,996	1,148,726	1,044,798	973,805
Employees.....Ave. No.	1,161	1,289	1,312	1,580	1,736
Wages paid.....$	867,071	1,259,344	1,486,677	2,045,072	2,695,507

[1] The figures for the year 1916 are for the Canadian Oil Companies, Ltd., and Imperial Oil, Ltd.

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PROVINCE OF ONTARIO
DEPARTMENT OF MINES

HON. H. MILLS, MINISTER OF MINES THOS. W. GIBSON, DEPUTY MINISTER

THIRTIETH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

VOL. XXX, PART VI,

1921

Boston-Skead Gold Area

By A. G. Burrows and P. E. Hopkins

and

Black River Area

By D. G. H. Wright

PRINTED BY ORDER OF THE LEGISLATIVE ASSEMBLY OF ONTARIO

TORONTO
Printed and Published by CLARKSON W. JAMES, Printer to the King's Most Excellent Majesty
1922

Printed by
THE RYERSON PRESS

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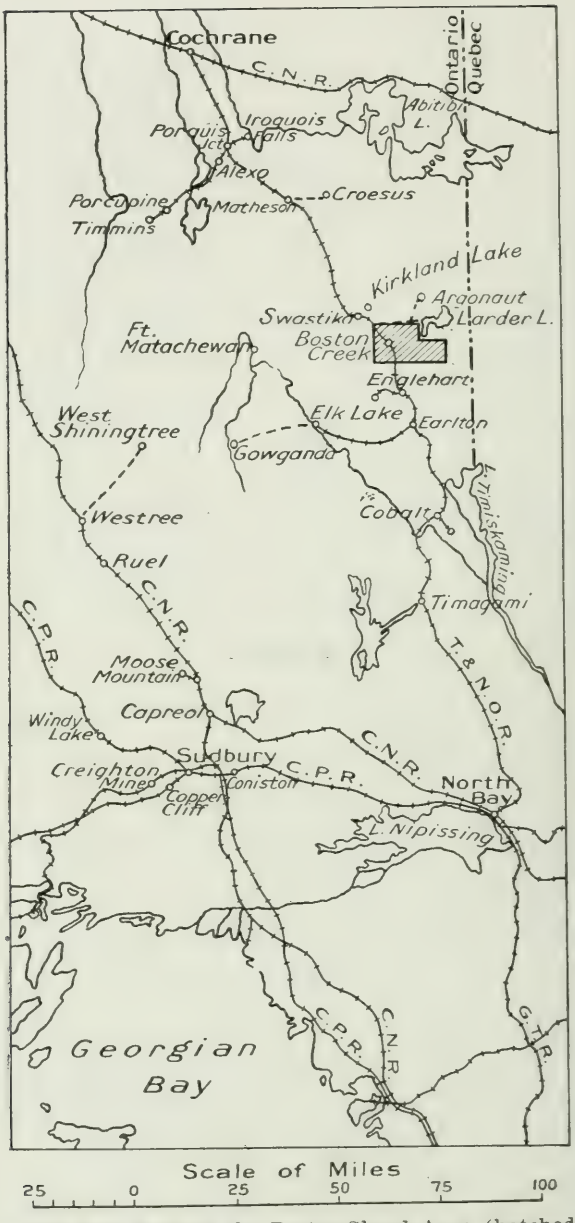


Key map showing the Boston-Skead Area (hatched) as related to other mineral areas in Northern Ontario.

BOSTON—SKEAD GOLD AREA

(Second Report)

By A. G. Burrows and P. E. Hopkins.

A report and map No. 25 d. were issued on the Boston Creek Gold Area in 1916. The area included the township of Pacaud and portions of the townships of Boston, McElroy and Catharine, in the vicinity of Boston Creek. The map accompanying the second report has been enlarged to cover in addition Catharine and Skead townships, where for several years there has been considerable prospecting activity with the discovery of gold on several properties. Further field work was done near Boston Creek in June, 1919, while the township of Skead was examined in May, 1921. The writers were ably assisted by A. W. Carlyle and K. B. Hersey in 1919, and by A. R. Clarke and D. E. Kearney in 1921. The writers wish to express their thanks to the mine officials and prospectors for their many courtesies.

The region is situated in the district of Timiskaming about 45 miles northwesterly from Cobalt and is traversed by the Temiskaming and Northern Ontario Railway. Boston Creek station, mileage 153, is approximately in latitude

A section of the Boston Creek-Skead road, west of the Blanche river.

45° N and longitude 80° W. By rail Boston Creek station is 382 miles north of Toronto. A wagon road, first constructed to the Miller-Independence mine, has been extended across Catharine into Skead township. The easterly part of the area is also reached by a good wagon road from Englehart.

Claims were staked for gold in this area in 1906 and 1907, during the days of the Larder lake gold rush. Again, in 1913, during the activity at Kirkland lake, 12 miles to the northwest, many claims were restaked and some work was done on them. Since May, 1915, following operations on the R. A. P. and Boston Creek gold mines in Boston township, there has been considerable activity from year to year. A small amount of bullion has been produced at the Patricia and Miller-Independence mines, but up to this time no steady gold producers have been developed.

Early Exploration of the Area

The first exploration was by Walter McOuat[1] who, in 1872, made a reconnaissance survey of the Blanche river from Lake Timiskaming to Round lake.

W. G. Miller[2], Provincial Geologist, in 1900 described a portion of the area. In his report the geology along the Blanche river in McElroy and Catharine townships is described. He also mentions prospecting for gold on a 4-foot quartz vein in the hill west of the lower end of a portage which is now shown in lot 9, concession III, Catharine township.

In 1904, after the discovery of Cobalt, W. A. Parks,[3] of the University of Toronto, made a geological survey of this portion of the country. Parks remarks that the high hills along the Blanche, in the township of Catharine, are well worth prospecting for gold.

In 1908 and 1909, M. E. Wilson examined the Larder Lake gold area, which is located to the northeast of Boston Creek. The geological map accompanying his report[4] takes in Skead township which is also shown on the Boston-Skead sheet.

Scene on St. Anthony lake, Skead township.

Topography

The area in general has an elevation varying from 700 to 1,050 feet above sea level. Boston Creek station has an elevation of 920 feet. While the difference in elevation is seldom more than 200 feet, the country is somewhat rugged and broken, particularly in the vicinity of Boston Creek station and along the north branch of the Blanche river in McElroy and Catharine townships.

The country is situated south of the continental divide, and is drained by three branches of the Blanche river and their tributaries which flow southward into Lake Timiskaming.

The magnetic declination is about 8 to 9 degrees west of north.

[1]Report on an examination of the Country between Lakes Timiskaming and Abitibi. Report of Progress, Geol. Sur. Can., 1872-73, pp. 112-135.

[2]Lake Timiskaming to the Height of Land, 11th Report Ont. Bur. Mines. 1902, pp. 214-230.

[3]The Geology of a District from Lake Timiskaming Northward. Summary Report, Geol. Sur. Can., 1904, pp. 108-225.

[4]Geology and Economic Resources of Larder Lake District, Memoir No. 17E., Geol. Sur. Canada, 1912.

General Geology

The rocks of the area covered by the accompanying geological map are of pre-Cambrian age. The dominant formations are members of the Keewatin, while formations of later age occur in relatively minor quantity, with the exception of a batholith of Algoman granite which covers the greater part of Pacaud township, and areas of conglomerate and greywacké of the Cobalt series in the east and south parts of Skead township.

The intrusive rocks, including granite and porphyry, which are believed to be associated with the gold mineralization, occur in small masses or narrow dikes through the older rocks.

LEGEND

PLEISTOCENE.	
GLACIAL AND RECENT—	Boulder clay, sand and gravel.
PRE-CAMBRIAN.	
KEWEENAWAN—	Quartz diabase, olivine diabase.
	Intrusive Contact.
ANIMIKEAN— (Cobalt Series)	Conglomerate, greywacké, quartzite.
	Unconformity.
ALGOMAN—	Hornblende and biotite granite, syenite, feldspar-porphyry, quartz-porphyry, lamprophyre.
	Intrusive Contact.
HAILEYBURIAN—	Serpentine.
	Intrusive Contact.
TIMISKAMIAN(?)—	Schistose conglomerate, greywacké, slate.
	Unconformity.
KEEWATIN—	Grey schist (volcanic fragmental), ellipsoidal, amygdaloidal and spherulitic lavas, diabase (in part altered to hornblende and chloritic schist), felsite, andesite, dacite, iron formation, rusty weathering carbonate.

Keewatin

The Keewatin rocks, which have such a wide distribution, occur in bands with a general northwest and southeast strike. In the southwesterly part of the area the Keewatin consists of volcanic fragmental material, for the most part fine-grained and irregularly banded. These rocks are about one-half a mile in width in the vicinity of Boston Creek station and extend for about seven miles, following the periphery of a batholith of granite in Boston, Pacaud and Catharine townships. Following across this band to the northeast there is a width of nearly two miles of lava flows, the principal rocks of which are basic lavas, altered basalt, and non-pillow lavas with diabasic texture. With these flows there are some light-colored volcanics, probably rhyolite, together with narrow bands, a few feet in width, of much crumpled iron formation, slate-like rocks, and rusty weathering carbonate. These rocks occur in the vicinity of the Miller-Independence, Allied, Boston-McRae, Authier, Patricia, Roger-Barnett and other properties along a

northwest-southeast strike. A third band of Keewatin runs across the southwest part of McElroy township, through Catharine to Skead and Bayly townships. These rocks are usually light-greenish in color, consisting of felsite, or andesite, and dacite, together with agglomerate. The agglomerate occurs in large volume in McElroy and Catharine townships, whereas the andesite is more prominent in the southwest part of Skead township.

The light-colored rocks are followed to the north-east by more basic lavas, iron formation and rusty weathering carbonate, prominently shown near the Blanche river in McElroy township and in the central part of Skead township.

The Keewatin rocks throughout the area are frequently altered to schist, being designed by such terms as sericite, hornblende and chlorite schist. Generally, the altered rocks contain considerable carbonate of lime, magnesia and iron, which, when present in quantity, gives a grey color to freshly broken surfaces, but is rusty brown at the outcrop.

Volcanic Fragmental.—A belt of banded, greyish-green schist, resembling an altered sediment has been differentiated on the map. These rocks, which occur on the periphery of a granite and syenite mass, are about one mile in width and 7 miles in length, passing in a semi-circular shape from Lot 12, Concession II, Catharine, through Boston Creek station to Round lake. The rocks may be best seen in the vicinity of Boston Creek station, where deep railway cuts have been made. The schist approaches a vertical altitude, with a strike parallel to the periphery of the granite. A great portion of the series consists of narrow alternating bands of rusty carbonate (including some magnetite and pyrite bands) and slate. Ash rocks, with bomb-like inclusions, are common. Some thin sections represent greywacké and quartzite, while one is clearly an altered porphyry. The whole series is greatly metamorphosed by the large granite mass, and is cut by narrow porphyry, lamprophyre and other dikes. In the vicinity of Round lake, much altered diabase and green chloritic dikes are intruded into the banded schist. At mileage 153 on the Temiskaming and Northern Ontario railway three bands of pyrite occur in the grey schist. The series was probably laid down conformably with the Keewatin pillow lavas.

Basalt, etc.—The greenstones are fine-grained, and consist of altered basic volcanics which are sometimes schistose, but more often massive. They commonly show the amygdaloidal and ellipsoidal structure, and more rarely the spherulitic, indicating their volcanic origin. The spherulitic structure, which is rare in basic rocks, has not been noted before in this section of Ontario. What may be the spherulitic structure in greenstone was reported on the north shore of Doig lake, in the northwest corner of Lebel township[1]. A similar structure was also seen under the microscope in an acid rock, a rhyolite, from lot 6, concession III, Beatty township[2]. In this area, spherulitic greenstones are beautifully developed on a bare hill on claim L 1878, Boston township. The varioles, which are rounded and white-weathering, vary in size from minute pea-like form to those about two inches in diameter, and constitute a large part of the rock. Under the microscope the varioles consist of coarse radiating flakes of chlorite, feldspar, epidote and probably quartz in a fine groundmass of the same material, and actinolite.

[1]Kirkland Lake and Swastika Gold Areas, Report Ont. Bur. Mines, Vol. 23, Pt 2, 1914, p. 4.

[2]Beatty-Munro Gold Area, Report Ont. Bur. Mines, Vol. 24, Part 1, 1915, p. 176.

Throughout the whole rock are pyrrhotite grains and numerous black ferruginous specks. The rock is probably an altered basalt. A similar spherulitic basalt occurs on the Roger-Barnett property in Catharine township.

The pillow lava flows constitute the main portion of the greenstone. They are interbedded in a northwest-southeast direction with much non-pillow greenstones, which have a diabasic texture at times, and some tuff, agglomerate and slate which point to a subaqueous origin. The nearly complete alteration of the greenstones, with the retention of their original ellipsoidal structure, is, according to Leith and Van Hise, due to the metasomatic rather than a dynamic change. Under the microscope the original minerals in the greenstones are hornblende, quartz, magnetite and plagioclase, the altered plagioclase laths suggesting a basaltic or diabasic texture. The secondary minerals are calcite, hornblende, chlorite, sericite and quartz. The altered greenstone in places may be spoken of as hornblende or chlorite schist.

Andesite, Dacite and Agglomerate.—A belt of light greenish-colored rock lying between two bands of basic lavas runs diagonally across the townships of McElroy, Catharine and Skead. There are several types of rocks in this group, the most prominent of which is andesite. It occurs in large volume in the vicinity of St. Anthony lake, extending southerly into Bayly township. The rock is usually fine-grained, resembling felsite, but phenocrysts of plagioclase are frequently recognized. Under the microscope the feldspar phenocrysts are set in a groundmass of feldspar, chlorite, epidote and calcite. Occasional irregular masses of chlorite suggest an alteration from a ferro-magnesian mineral. The following analyses (1) and (2) show the composition of the rock.

TABLE I.—ROCK ANALYSES.

	(1)	(2)	(3)
Silica	60.46	63.78	68.56
Alumina	16.85	15.86	15.16
Ferrous oxide	4.19	2.66	0.99
Ferric oxide	1.70	0.96	3.23
Lime	4.70	5.01	2.26
Magnesia	1.36	2.58	1.51
Potash	0.52	0.25	1.04
Soda	4.82	4.96	6.10
Carbon dioxide	3.98	2.67	0.22
Water	0.90	1.42	1.22
Total	99.48	100.15	100.29

(1) N.½ lot 7, con II, Skead township. (2) South boundary of Skead township in lot 4. (3) East side St. Anthony lake. Analysis—W. K. McNeill and T. E. Rothwell, Provincial Assay Office.

Intruding the andesite in the form of irregular dikes and stocks, there is a coarse-grained porphyritic rock of light greenish color, which is probably a dacite or quartz-diorite-porphyry. The prominent minerals are quartz and plagioclase, and occasional ferromagnesian mineral, altered to chlorite, in a groundmass of feldspar, chlorite and epidote. The rock has likely been derived from the same magma as the andesite. It occurs prominently to the east of St. Anthony lake. A specimen of the rock has the composition shown in column (3) above.

With the andesite type of rock, particularly in McElroy and Catharine townships, there is a fragmental rock of volcanic origin. It contains numerous fragments of light-colored volcanic rocks together with some fine-grained, stratified,

ash-like material. It is well exposed along the boundry between McElroy and Catharine, in lots 10, 11 and 12.

Iron Formation.—Iron formation, consisting of interbanded silica black slate and magnetite, occurs with greenstone on a number of claims among the Dane-Larder Lake road in Boston township. This range has been described in detail by W. G. Miller[1] and other writers[2].

There are a number of narrow bands of the formation in McElroy township to the west of the Blanche river. Some of these carry considerable iron pyrites, and on claim 4410 a small quantity of iron pyrites has been separated from the silicious iron formation during the sinking of a shaft.

Similar narrow bands occur on the Fidelity claims north of St. Anthony lake. The formation has been fractured and contains vainlets of quartz carrying pyrites. Gold has been obtained in material from prospect pits on several outcrops of iron formation.

Carbonate Rock.—Bands of rusty-weathering carbonate of lime, magnesia and iron occur in parts of the area. These have the prevailing strike of the district namely, northwest and southeast. Generally they are cut by irregular veinlets of quartz and sometimes by masses of porphyry. Several of the outcrops have been partially prospected for gold. These include the Cook property in the north-west part of Skead and the adjoining part of Hearst township, and the Lincoln-Nipissing claim, C.E. 3, Skead township.

Timiskamian

A few small, isolated patches of schistose conglomerate, slate and greywacké, standing in a vertical attitude, occur along the Larder Lake road in Boston and McElroy townships. The rocks are similar to the sediments classed as Timiskamian on the map of the Kirkland Lake and Swastika gold areas. The pebbles of the conglomerate, which are elliptical in outline, consist largely of greenstone and felsite and some iron formation. A grey magnesian limestone occurs both as pebbles and matrix in the conglomerate in McElroy township about a mile east of the three-mile post on the west boundary.

There is an area of schistose sedimentary rocks in the north and northeast parts of Skead township. The series is represented by slate, quartzite and conglomerate, which, in places, are greatly altered and difficult to determine.

The conglomerate in the northeast corner of lot 6, concession VI, Skead township, contains many pebbles 2 inches in diameter, some of which are quartz-porphyry, granite and greenstone. In the southeast corner of the same lot the bedding of the conglomerate and greywacké is north and south, while the schistosity is northeast-southwest. The usual strike and dip of the beds in the sediments is much the same as the Keewatin lavas, namely, northwest-southeast and nearly vertical dips.

Pre-Algoman (Haileyburian?)

Serpentine.—There are isolated exposures of serpentine in various parts of the area.

---

[1]Boston Township Iron Ranges, Vol. XIV, Ont. Bur. Mines.

[2]Kirkland Lake and Swastika Gold Areas, Vol. XXIII, Part II, Ont. Bur. Mines.

The trail on claim L. 4902, Boston township, passes over an exposure of serpentine. A thin section of the rock was examined microscopically and found to consist of about 60 per cent. serpentine and 40 per cent. calcite. Numerous magnetite grains and a little pyrite are scattered through the rock.

Serpentine occurs in small areas on and north of claims W.R. 97, to the west of the Blanche river, McElroy township, and in the northern part of Catharine township.

The largest exposures of serpentine are scattered across the northerly part of Skead township. The rock is readily recognized in the field by its light weathered surface and greasy feel in freshly broken fragments. No chromite, or asbestos, was recognized in specimens from the various serpentine outcrops.

Algoman

These rocks include batholith and stocks of granite and syenite, and dikes of feldspar-porphyry and lamprophyre. They are massive, fresh-looking, and are probably Algoman in age, since similar granite in Boston and Lebel townships to the north was found cutting the Timiskamian series.

Granite and Syenite.—A batholith of red, biotite granite occupies nearly all of Pacaud township, and extends to the south and west for miles beyond the township boundaries. The rock is massive, except near the contact with the Keewatin, where it occasionally takes on a gneissoid structure. Near the contact with the greenstone, just south of mileage 153, the granite is intruded by numerous parallel felsitic dikes which give the rock a banded structure. It is cut by quartz veins, and by pegmatite and other dikes representing various differentiation facies of the magma. The rock in the south part of lot 9, concession VI, Pacaud, is a light grey, medium-grained biotite granite. Under the microscope microcline is seen showing the gridiron structure, albite partly altered to sericite, biotite altered partly to hornblende and chlorite, quartz and calcite.

A reddish syenite outcrops in the west part of Boston township, being part of the large syenite boss-like mass occupying most of Otto township.

A small stock of reddish biotite and hornblende granite intrudes the greenstones in McElroy township. Gold and a telluride have been found in this granite in a pegmatitic quartz vein which is probably a part of the granite magma.

The gold-bearing quartz veins at the Wisconsin-Skead property in Skead township occur in a dike of red granite with which the gold is probably genetically connected.

Other small irregular, granite dikes cut the greenstones and felsitic rocks. Gold was seen in quartz veins in these small granite dikes on claim L 5165 and L 5133, Boston township.

Feldspar-Porphyry.—Numerous intrusions of massive red and grey feldspar-porphyry occur over the whole area. They appear as narrow dikes up to thirty feet or more in width, and probably represent apophyses from the granite masses. The phenocrysts usually consist of albite, often showing a zonal structure, an occasional rounded quartz grain, and blades of biotite in a microcrystalline groundmass of quartz, feldspar, chlorite and calcite. Fine grains of magnetite and pyrites, and crystals of apatite are often present. A feldspar-porphyry on claim L 2000, Boston township, and in other parts of that vicinity, contains white feldspar phenocrysts up to one inch across, which show beautiful zonal structure in the

hand specimen. Some porphyry dikes in the southwest part of Boston township contain many prominent quartz phenocrysts, and thus resemble the quartz-porphyry at Porcupine. In other parts the rock may be called a felsite. The acid dikes are usually cut by minute veinlets of quartz, some of which carry gold. Small, irregular fragments of red feldspar-porphyry are also, at times, present in auriferous quartz veins.

Lamprophyre.—A few narrow lamprophyre dikes cut the greenstones and grey schist, but these are too small to map. They may be seen on the south part of lot 3, concession VI, Pacaud township, and at about mileage 154.3 along the railway. In the Kirkland area the lamprophyre cuts the Timiskaming sediments, but is older than the feldspar-porphyry. A lamprophyre dike that intrudes the Algoman granite can be observed in a rock-cut about half a mile north of Mindoka station.

Some red lamprophyre occurs in the northwest part of Skead township, and the adjacent part of Hearst township. It is associated with porphyry dikes very similar to the occurrence at Kirkland lake. It is also found on the Crawford claims in lot 9, concession V, of the same township.

Animikean

The youngest sedimentary rocks consist of greywacké, quartzite and conglomerate, which occur in prominent ridges in the east and southeast parts of Skead township. They represent erosion remnants of the sedimentary series which can be traced at intervals southerly to Cobalt. The rocks in the vicinity of Hough Lake are 200 or 300 feet in thickness. The sediments are nearly flat-lying, with dip generally up to 15°. On lot 12, concession V, Skead township, a portion of the rocks dip 60° easterly. No deposits of economic importance have been discovered in the late sedimentary rocks in this area. They were deposited subsequently to the deposition of the gold-bearing veins. A portion of the Flannigan gold-bearing vein, on lot 7, concession III, Skead township, is covered by a bed of conglomerate 10 feet in thickness.

Keweenawan

Quartz diabase dikes are rare in this area; however, they were noted cutting the greenstones and Timiskamian(?) sediments. These dikes are classed as Keweenawan, since they are fresh-looking and resemble the diabase at Cobalt. A thin section of a sample taken immediately south of M.R. 15, Boston township, shows labradorite laths, partly altered to saussurite and sericite, augite partly altered to hornblende and chlorite with a little quartz, biotite, magnetite and intergrowths of quartz and feldspar.

There are several outcrops of diabase in the north-east part of Skead township. These represent remnants of the Keweenawan diabase sill. A calcite vein carrying galena, which occurs in this rock, is referred to elsewhere in the report.

Glacial and Recent

The region has been heavily glaciated, the ice having moved in a general S. 20° E. direction, astronomic.

The area lies at the northern edge of a tract of farming land, which extends from Haileybury to Round Lake, and is covered in places with stratified clays, sand and gravels. At Boston Creek Station one can see the vertical section of

a moraine deposit which has been cut into by Boston creek. The central part of McElroy township, to the east of the Blanche river, is one vast area of sand and gravel, representing, probably large terminal moraines and outwash plains. The glacial drift extends southerly into Catharine township where it occupies the greater part of the easterly portion of the township. In lot 3, concession III, there are several remnants of old kettle lakes. In this same vicinity the sands are overlain by a thin clay deposit, suggesting damming during glacial times. The sand and gravel also extends easterly into the northwest portion of Skead township, and southerly into Marter township. The gravel ridges are the source of several fine springs, one of which is the headwaters of Spring Creek, in Catharine.

Origin of Gold Deposits

As pointed out by W. G. Miller and C. W. Knight in a paper entitled "Metallogenetic Epochs in the Pre-Cambrian of Ontario,[1]" most of the gold deposits of Ontario belong to the Algoman epoch. The gold deposits of Boston creek supply another example of gold being derived from acid intrusives of Algoman age. The granite, syenite and feldspar-porphyry exposed in this area by erosion are probably different facies of a plutonic rock which underlies the whole area. The gold generally occurs near these acid rocks. The presence of a number of gold-bearing veins along the contact of the intrusive porphyry and older rocks at Boston creek, as in many other parts of central Canada, and the frequent occurrence of auriferous quartz veinlets in the porphyry and granite, suggest the relationship between the intrusives and the veins. The relationship is more clearly shown in this area by the occurrence of gold in a pegmatitic vein in the granite on the Charest claim, McElroy township.

The deposits are in part due to the replacement of the country rock by mineral solution.

Only a few minerals which characterize deposits that are formed at high temperatures are found in the veins at Boston creek. Actinolite was noted in a thin section of material from the Kenzie vein, and specularite has been frequently observed in other veins. Tourmaline formed at high temperature has been noted in quartz veinlets at the Catharine gold property. It is probable that the deposits were formed at great depth, but not at extremely high temperature.

Economic

Gold.—Gold, the chief mineral sought for in the area at the present time, occurs, usually native, but occasionally combined with tellurium, in quartz veins and veinlets in the Keewatin greenstone and later intrusions of granite and porphyry. The veins, which have various strikes and dips, are well mineralized with varying quantities of pyrite and molybdenite, and sometimes with chalcopyrite, galena, specular hematite, cosalite, native bismuth, gold and tellurides. The gangue consists largely of quartz of several generations, with considerable calcite and chlorite. The gold is found along the dark streaks of chlorite and calcite.

There are many types of gold deposits, viz:

(a) Fissure quartz veins in the greenstone, granite and porphyry, with well-defined walls. Examples: No. 1 vein at Miller Independence, Boston-McCrae, Authier, Patricia and Wisconsin-Skead.

[1]Rep. Ont. Bur. Mines, Vol. XXIV, Part 1, 1915, pp. 243-248.

(b) Replacement veins. The country rock, including altered greenstone and porphyry, has been brecciated and partly replaced by vein-forming solutions of quartz of several generations, and by calcite and other carbonates. Examples: the calaverite vein on the Miller-Independence and the Kenzie vein on the R.A.P. property.

(c) A stockwork in granite and porphyry. Examples: Charest (L. 5305), Authier (L. 4737), and Papassimakes (L. 5133).

The chief deposits will be described later in the report when dealing with the gold claims.

Iron Pyrites.—In the first railway cut north of Boston creek station there are two narrow bands of pyrite, 10 to 20 inches wide, with some disseminated pyrite in the adjoining schist. The pyrite on assay showed the absence of gold; the exposed deposit is of no economic value. Two shallow pits have been put down on the eastward extension of the deposit and at present a little pyrite can be seen on the dumps.

On the Marsh claim, 4410, McElroy township, a shaft has been sunk 80 feet on an iron-formation band some 50 feet in width. Fairly solid pyrite extends over a width of six feet and eight or ten tons of massive pyrite have been separated on the dump.

A twenty-five foot pit has been sunk on a quartz deposit carrying some grains and nodules of pyrite on the Sharp claim, H.S. 914, Rattray township.

Magnetite.—The isolated exposures of iron formation along the Larder Lake road, in Boston township, represent the southern portion of the Boston township iron range. The formation consists of interbanded silica and magnetite, with some black slate. Numerous shallow test pits were sunk in 1902, but the iron proved to be too low in grade to be workable at that time. The iron formation is, in places, intruded by quartz veins, some of which carry gold.

Argentiferous Galena.—There are two occurrences of argentiferous galena in Skead township, one on the *Mageau-Authier* claim, W.D. 1001, in lot 12, concession V, the other on the De Villiers claim on the west central part of lot 12, concession VI. On the former location a 50-foot shaft has been sunk vertically on a quartz-calcite vein in a Keweenawan diabase sill remnant. The vein strikes 15° north of east, averages 6 inches in width, the calcite in places containing galena, zinc blende, cobalt bloom and pyrite.

On the *De Villiers* location is a calcite vein from a few inches to one foot in width, averaging about 6 inches, striking 15° north of east and dipping vertically. The vein, which has been uncovered for a distance of 450 feet, lies in Keewatin diabase and basalt, Timiskamian conglomerate and Algoman porphyry, and apparently passes under a Keweenawan gabbro remnant on the west. The vein contains zinc blende, cobalt bloom, pyrite, and, in places, large pieces of galena which, on analysis, showed 4 ounces of silver per ton and no gold.

Calcite veins carrying galena are reported to have been found on claims L. 66 and L. 67, on lots 11 and 12, concession IV, Skead township.

M. E. Wilson, in his report on the Larder Lake Area, refers to a silver-lead occurence on claim B.G. 329, on the Hearst-McElroy boundary, 4 miles north of Skead township, owned by the *North Canadian Gold Mines, Limited.* "Several irregular veins of galena, blende, and chalcopyrite, up to 10 inches in width, occur

in Keewatin greenstone. They all pinch out quickly when followed along the strike." [1]

Building Stone.—The red and grey granite and syenite along portions of the railway in Pacaud township is serviceable for building purposes. The station at Matheson, which was burned in 1916, was constructed of stone taken along the railway immediately to the north and south of Mindoka station.

Timber and Agriculture.—In general the trees are small, and consist of spruce, jack pine, poplar, birch and cedar. A few white pine, three and one-half feet in diameter, to the southeast of Smith lake, have escaped an old fire which swept most of the area. Large charred stubs of pine in various parts of the area are relics of the same fire. Other parts have been recently burned.

Many farms have been located on the scattered clay areas of Pacaud township, while the greater part of the remaining area is unsuitable for agriculture by reason of rock, sand or swamp.

Power.—The Northern Ontario Light and Power Company's transmission line, from Cobalt to Kirkland Lake, passes through the area. The Miller Independence mine is operated by power furnished from this line. The transmission line from Charlton to Kirkland Lake runs along the west boundary of Pacaud and through the westerly part of Boston township. The Wisconsin-Skead Company expects to get power from Raven falls in McFadden township.

The branches of the Blanche river, which flow through the area, have several waterfalls which could be utilized for power. One of these is on the northwest branch in lot 12, concession IV, Pacaud. On August 12th, 1914, the discharge of the river at this point was 350 cubic feet per second. The 61-foot falls in expected to develop 405 horsepower. Immediately to the north, in concession V, is a 36-foot falls which could be utilized to develop additional 240 horsepower.

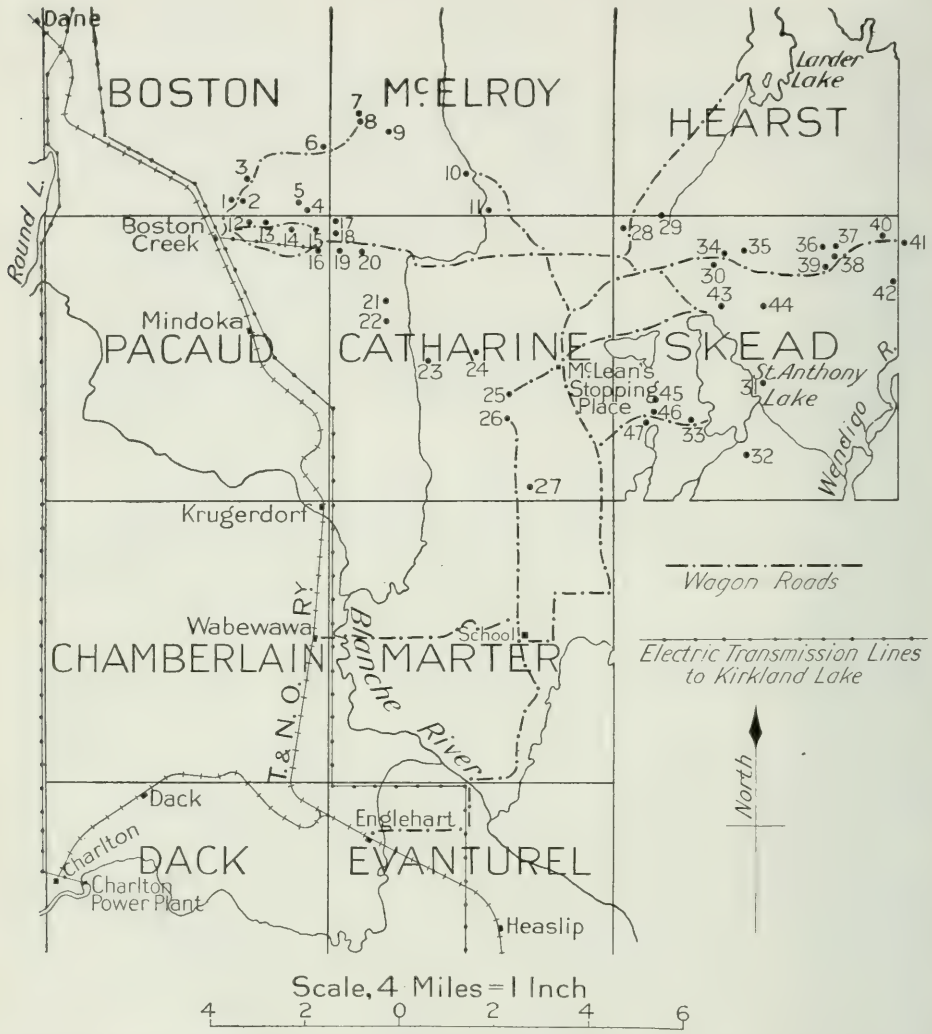
A larger possible waterpower is situated at High Falls on the north branch in lot 11, concession IV, Marter township, where a total operating head of 138 feet is available. The discharge of the river on May 6th, 1915, was 352 cubic feet per second. Messrs. M. Hotchkin and G. Grover, who surveyed the waterpower at that time determined a minimum of 2 000 horsepower available.

Description of the Gold Prospects by Townships

Boston Township

R.A.P.—The first discovery of gold in Boston Creek was made in 1914 in the "Kenzie" vein, which extends from claim No. L. 3665 to claim No. L. 5163 in the south central part of Boston township. During that year some work was done on the vein by La Rose Mines, Limited. During 1916, the R.A.P. Syndicate, controlled by E. M. Richardson, W. B. Albright and J. K. Papassimakes, continued development on the Kenzie vein on L. 5163. The inclined shaft was sunk to the 200-foot level and drifting done as follows: On the 100-foot level, east drift, 250 feet; west drift, 175 feet; 200-foot level, east drift, 90 feet; west drift, 190 feet. Development has shown the ore to occur in small shoots in the vein. The vein strikes 30° north of east, and dips 65° S. in massive pillow lava. The vein varies from several inches up to 5 feet in width with good breaking walls on either side. The vein material consists of quartz of several generations, silicified rock,

[1] Memoir No. 17 E., Geol. Sur. Canada.



OUTLINE MAP OF BOSTON-SKEAD AREA SHOWING THE RELATIVE LOCATIONS OF THE MINERAL PROSPECTS MENTIONED IN THIS REPORT.

BOSTON

1 Boston Creek
2 R. A. P.
3 Currie
4 Authier
5 Ivanhoe-Boston
6 Gold Leaf

McELROY

7 Hughes-McElroy
8 Peerless or Mondoux
9 Charest
10 Marsh
11 Irish

PACAUD

12 O'Donald
13 Patricia or Barry-Hollinger
14 Boston McCrea
15 Allied Gold
16 Miller Independence

CATHARINE

17 Campbell
18 Cotter
19 Connell-McDonough
20 Kennedy-Boston
21 Burnand-Gzowski
22 Catharine Gold
23 Ostrum
24 Daley
25 Walsh-Taylor
26 Roger-Barnett
27 Hounslow

SKEAD

28 Zenith Gold
29 Cook
30–33 Flanagan
34 Lincoln-Nipissing
35 Manley-O'Reilly
36 Martin
37 Sampson
38 Wisconsin-Skead
39 Crawford-Skead
40–41 DeVilliers
42 Mageau-Authier
43 Fidelity
44 Barry Webster
45 Nigger
46 Skead Gold
47 Telluride Syndicate

reddish calcite, and brecciated and partly replaced masses of reddish feldspar-porphyry. The occurrence of feldspar-porphyry in various parts of the workings suggests that originally the greenstone was intruded by a narrow feldspar-porphyry dike, that at a later period was greatly brecciated and impregnated with vein-forming solutions which carried the gold and other minerals. The gold occurs with a very fine-grained greenish quartz, which has the character of a replacement deposit, while the green colour is due to minute inclusions of chlorite. Iron pyrites is finely disseminated in the vein, and copper pyrites, molybdenite and galena occur in minor quantity.

Thin sections of the ore show the gold to be closely associated with the sulphides in chlorite and calcite seams near the footwall part of the vein, where there is a narrow band of fine-grained greenish quartz. Certain sections of the vein run as high as $25 or $30 in gold to the ton, across five feet.

On the east side of claim L. 2631, which lies immediately northeast of that on which the main shaft is sunk, there is an irregular band of mineralized schist with quartz, about one foot wide, which contains visible gold. The showing occurs where the greenstone is intruded by a dike of feldspar-porphyry, and near the contact.

The plant includes one 60-h.p. Jenckes locomotive-type boiler, and one 5 by 7 Jenckes hoist. Work was discontinued by the syndicate on September 17th, 1916, and the shaft and hoisting equipment rented to the Boston Creek Mining Company. In July, 1917, preparations were under way to take over the shaft and resume work.

Boston Creek.—The Boston Creek Mining Company, Limited, did considerable development work on claim L. 3665 in Boston township during the year 1916. Work was carried on through the R.A.P. shaft, which was rented with hoisting equipment from the R.A.P. Syndicate.

The drifts on the 100- and 200-foot levels of the R.A.P. were extended into the Boston Creek ground and a raise carried to the surface from the 200-foot level. A winze has been sunk 200 feet from the 200-foot level, and stations cut at the 300- and 400-foot levels. Development is as follows: 100-foot level, 325 feet of drifting and cross-cutting; 200-foot level, 300 feet of drifting and cross-cutting; 300-foot level, 50 feet of drifting and cross-cutting; 400-foot level, 300 feet of drifting and cross-cutting.

The vein is a continuation of the "Kenzie" vein from the R.A.P., and similar in appearance. Spectacular gold showings were obtained in the upper 30 feet of the shaft and a few very small shoots were obtained in the deeper levels.

In February and March, 1917, new buildings were erected, including office, sleeping camps, dining-room and store-house. Operations were suspended in July, 1917, to permit of exploration by diamond-drilling. Air is supplied by two Chicago Pneumatic Tool Company fuel-oil compressors.

Ivanhoe-Boston.—On claim No. L. 5079 is a quartz vein of a few inches to 4 or 5 feet in width which strikes northeast-southwest and dips approximately 65° to the southeast with numerous quartz veinlets running nearly at right angles on either side. Some cosalite carrying high values in gold and silver occurs in one portion of the vein. The wall rocks are massive Keewatin diabase and pillow lava which are extremely altered for a few inches next the veins.

Currie (L. 5037).—In the northwest part of the claim are rusty schist bands heavily mineralized with iron pyrites and cut by quartz stringers. No visible gold could be seen in place, but gold colours can be panned from the sulphides. A grab sample showing cubes of pyrite gave $2.40 in gold to the ton, while samples across two feet and three feet seven inches gave $1.60 and 60 cents respectively in gold to the ton.

Authier.— Visible gold has been found on a number of veins on the Authier claims, Nos. L. 4734 and L. 5025, which are situated in the southeast part of Boston township. The veins are from a few inches to three feet in width and occur in greenstone, iron-formation, granite and porphyry. The deposits strike a little north of east and dip from 20° to 45° to the north, although some veins dip to the south. There are often cross veins forming a stockwork. The veins contain much disseminated iron pyrites and small quantities of chalcopyrite, specular hematite, molybdenite, bismuthinite, magnetite and tetradymite, but on the whole sampling has shown the gold content to be low.

Gold Leaf (L. 5757).—A shaft has been sunk on a quartz vein together with numerous stringers of quartz which intersect a reddish, medium-grained hornblende granite. The main quartz vein strikes N. 60° E., and dips 60° northwesterly. This vein is from two to four feet wide and is accompanied by quartz stringers over a width of ten feet. Fifty feet northeast of the shaft the deposit has been faulted to the west with a horizontal throw of thirty feet. The quartz has a somewhat banded character and carries iron pyrites, copper pyrites, pyrrhotite and molybdenite in film-like structures. The property was not in operation at the time of visit.

About a mile west of the Gold Leaf, on claim No. L. 5165, is a similar granite cut by narrow white quartz veins, some of which carry molybdenite and a few specks of native gold..

Pacaud Township

O'Donald.—The O'Donald claim, the N.E.¼ of the N.½ of lot 4, in the sixth concession of Pacaud township, has four nearly parallel E.-W. veins, which dip from 60° to 70° to the south. The south vein, which is considered the most promising, consist of schist, quartz and pyrite, across a width of eight or ten feet. A nineteen-foot shaft was sunk on this vein and later the vein was cut underneath the shaft at a vertical depth of 200 feet by a diamond drill. Neither the Crown Reserve nor the Allied Gold Mines exercised its option. The rocks are Keewatin, diabase and pillow lava cut by aplite, feldspar-porphyry and hornblende-mica syenite.

Patricia.—The Patricia (Barry-Hollinger) consists of two claims in the north half of lot 3, in the sixth concession of Pacaud township. A mining and milling plant was placed on the property and the mine was operated for a short time in 1917 and 1918 by the late C. A. O'Connell. A forest fire in July, 1919, burned the mine buildings and mill, the mine not being in operation at the time. A description of mining and milling operations is given on page 101, Part 1, Vol. 27, Report Bureau of Mines. Twelve veins were found on the property, but underground operations were chiefly confined to vein No. 7, with a small amount of work on a parallel vein to the north. An inclined shaft was sunk 215 feet on No. 7 vein, that dips 74° S. with orepockets at the 100 and 200-foot

levels and drifts along the vein on these levels. Two stopes, 25 feet and 130 feet in length, were opened up on the 100-foot level in the west drift, and one stope 80 feet long on the 200-foot level. The stopes were carried up about thirty feet before milling operations were suspended.

The ore is banded quartz of rather fine grain and carries a small percentage of iron pyrites, and some copper pyrites and zinc blende; it frequently shows native gold in hand specimens. The quartz varies in width from about twelve to thirty inches. In the west drifts on the two levels, bands or lenses of calcite were encountered with a narrowing of the quartz. The values are contained in the quartz vein with little mineralization of the enclosing basic rock. The ore raised from the mine was of good grade, approximately $18 per ton.

Boston-McRae.—The Boston-McRae Gold Mines comprises four claims in the north half of lot 2, in the sixth concession of Pacaud township. The rocks are pillow lava and associated volcanic flows with narrow bands of iron formation, the general strike of the formations being N.W. and S.E. The volcanic rocks are partly altered to carbonate. A number of mineralized zones have been found, generally containing irregular veinlets and masses of quartz. A well defined quartz vein, with N. and S. strike and dip 45° E., occurs in the northeast part of the property. An inclined shaft was sunk in 1916 by former operators. The vein averaged about twelve inches in width and visible gold was observed in the hanging-wall at a number of points. This vein is cut by a diabase dike to the south of the shaft. Further work was done near the north line to the west and a shaft started on a series of lenticular quartz veins dipping gently to the east. The shaft was down fifteen feet showing a series of quartz veinlets on the east wall for eight feet from the surface. Native gold and tellurides with iron pyrites have been recognized in the ore. Some faulting was observed in the shaft. The surface where the quartz stringers occur is highly oxidized, this condition being traced to the Authier claim on the north. The rock below the surface shows the characteristic grey colour of basalt altered by carbonate with quartz and sulphide.

On the south central part of the property a shaft has been sunk on a wide schist zone carrying quartz stringers, iron pyrites and copper pyrites and some value in gold. To the east of the shaft there is a serpentine dike and a coarse hornblendite.

Allied Property.—The Allied Mining Co. operated the Renaud-Cullen group, consisting of the north half of lot 1 in the sixth concession of Pacaud township, during parts of the years 1918 and 1919. Much trenching was done on the south central part of the property, where the basalt carries irregular stringers of quartz in a general N.W.-S.E. direction. One trench shows mineralization over a width of sixty feet across narrow bands of quartz in the basalt, the rock being altered along the quartz veinlets to a grey color and containing grains of iron pyrites. A little copper pyrites and calcite occur in the veins. Some low gold assays were obtained in the fractured zone, but no commercial ore was found. Work was also done on the southeast part of the property where the basalt and other Keewatin rocks are intruded by a small irregular body and narrow dikelets of granite. A number of narrow quartz veins, from an inch to a few inches in width, were discovered in the granite or basalt near the contact, and some visible gold with a black telluride found in some veins. Needle-like crystals of bismuthinite were observed in one quartz veinlet. Gold was also found in irregular veinlets of quartz

in a red porphyry dike eight feet in width. A shaft was sunk 100 feet on a fracture along an E.-W. basic dike, cutting the Keewatin.

Diamond drilling was done in the vicinity of the south line near the Miller Independence. Three shafts were sunk to moderate depths at an earlier time by former operators.

Miller Independence.—This property, which is one of two in the area which has produced some gold, is situated on the south half of lot 1, in the sixth concession of Pacaud township. Gold was first discovered on the lot in No. 1 vein by Joseph McDonough in July, 1915. Three years later W. Adams, then mine captain, discovered the "Independence Vein," which contains a small shoot of ore carrying a precious telluride, calaverite. All the recent work has been done in connection with this vein.

The geology is comprised dominantly of alternating flows of Keewatin pillow lava (meta-basalt), altered diabase or dacite, with which are associated subordinate amounts of rhyolitic schists, agglomerate, iron-formation and tuffs, all of which have a N.W.-S.E. trend. These rocks are cut by small granite stocks and feldspar-porphyry dikes. In the vicinity of the veins the rocks contain abundant calcium magnesium and iron carbonates.

The original No. 1 vein has been traced on the property for about 600 feet in an east and west direction and for several hundred feet easterly into Catharine township. It is narrow, averaging about a foot in width, and has a low dip to the north, usually about 20° or less, at one place being almost horizontal. The vein material is milky white quartz, and the mineralization is more or less concentrated toward the footwall side of the vein. Tellurides, copper pyrites, pyrite, specular iron ore and galena are observed in the quartz. Native gold occurs frequently with the telluride in a net-like arrangement in the quartz along the footwall. A bismuth telluride, brilliant grey in color, and containing some selenium, occurs abundantly with the gold. A darker-coloured telluride (petzite?) is also present in smaller amounts. The vein has been prospected by means of a number of trenches, pits and shafts from which some high-grade ore was bagged and a small production recorded. Along parts of both walls of the vein there is a narrow dike of grey feldspar-porphyry. The porphyry contains much calcite and other carbonates, as well as disseminated iron pyrites and is cut by veinlets of quartz.

The Independence vein, containing the small shoot of exceptionally high-grade ore, strikes No. 22° E., and dips 55° southeasterly. The rich ore was found between the depths 30 feet and 160 feet in the inclined shaft, but could not be traced for any great distance on the 100-foot level. The hanging wall of the shaft is a strong fault plane. Below this is a second fault plane nearly parallel to the upper one, the planes varying from a foot to three feet apart. Below the lower fault plane is a series of irregular quartz veinlets from a fraction of an inch to one inch in width and roughly parallel to the fault plane. A few veins are terminated sharply at the fault plane, indicating that some of the faulting is later than the mineralization. About ten feet above the 100-foot level the veinlets occur over a width of four feet. These veinlets can be followed down to 160 feet in the shaft below which the rock is less altered. Where the veinlets occur, the dark basalt has been altered for a few inches to a light grey rock carrying abundant iron pyrites. The quartz carries in places iron pyrites and copper pyrites together with gold telluride, calaverite. The telluride occurs chiefly in minute veinlets and small masses in and with the copper pyrites and is sometimes accom-

panied by native gold. Faulted sections of flat-lying quartz veins were observed between the main fault planes about fifty feet below the 100-foot level.

Shaft No. A has been sunk vertically to a depth of 500 feet and extensive exploration carried on at this level. The strong faults on which the inclined shaft "D" was sunk to the 200-foot level were encountered in the cross-cut on the 500-foot level, 190 feet north of "A" shaft; drifting along these faults did not reveal any ore of similar character to the rich telluride ore which was found in "D" shaft. Seven diamond-drill holes were made from the 500-foot level. The mine is run by electricity supplied by the Northern Ontario Light and Power Company. W. S. Simpson is manager of the mine.

McElroy Township

Peerless.—The Peerless property comprises a group of claims formerly the Mondoux, located in the west part of McElroy township. The rocks are principally of Keewatin age and are intruded by small masses and dikes of granite. Work has been largely confined to claim 5266, where a strong quartz vein crosses the claim in a N.E.-S.W. direction. The vein would average about six inches in width, but is lenticular in structure. At a point where the vein intersects a N.W.-S.E. granite dike, a shaft has been sunk to a depth of 250 feet. The dike dips steeply to the west and below the 75-foot level is to the west of the shaft. Exploration has shown a small lens of ore in the vein lying to the west of the granite dike. This ore was opened up by a stope from the 75-foot level to the 50-foot level, and a few tons of ore taken from the workings. Exploration at 125 and 250-foot levels did not reveal ore of a similar character. The ore is of a peculiar type, being brecciated and containing fragments of greenstone and much calcite with the quartz. The ore minerals are native gold, native bismuth, copper pyrites, iron pyrites, galena, zinc blende, pyrrhotite, and a rare mineral containing lead, bismuth and sulphur, which was determined at the Department of Mineralogy, Toronto University, to be cosalite.[1]

Charest.—The Charest claim, L. 5305, is situated in the south-west quarter of McElroy township. As shown on the map the claim is on a small stock of massive, coarse-grained, flesh-coloured hornblende and biotite granite. A quartz vein, averaging about one inch in width and three hundred feet long, strikes 30° north of west across the granite. Considerable fine gold, pyrite, chalcopyrite, and a grey telluride were noticed in different parts of the vein. Other veins on the property contain molybdenite and specular hematite. Some of the veins contain coarse feldspar and are pegmatitic in character, while many of the narrow veins represent the filling of joint cracks. The occurrence of gold in the pegmatitic vein strongly points to the formation of the gold-bearing quartz veins following the pegmatitic veins and representing part of the granite intrusion.

Marsh.—Near the centre of claim No. 4410, McElroy township is an iron formation band striking N.W.-S.E. on which a shaft has been sunk to a depth of eighty feet. Much gossan occurs on the surface, below which are interbanded pyrite and sugary quartz over a width of fifty feet. Across a width of six feet the pyrite is fairly massive. About 100 cubic feet of massive iron pyrites are on the dump.

[1] Cosalite from Ontario by T. L. Walker, University of Toronto Studies, Geological Series No. 12, 1921.

Irish.—On the central part of claim L. 2581 a 440-foot tunnel has been driven on a white calcite vein which varies from 4 to 8 feet in width. The vein strikes N.E.-S.W. and dips 75° to the south east. A winze has been sunk at a point near the centre of the tunnel.

Near the northern part of the same claim a 35-foot tunnel has also been made on a quartz vein about one foot wide and containing iron pyrites.

Catharine Township

Ten chains east of the northwest corner of lot 9, con. VI, Catharine, there is a quartz vein in volcanic fragmental rocks. The vein strikes N. 75° E. and dips 80° S, showing in places 8 inches in width together with lenses of calcite a foot in width. The quartz carries copper pyrites and has been traced by trenching 50 feet. The same vein has been located four chains to the north-east in McElroy township where some trenching has also been done.

Campbell.—The Campbell property consists of two claims in the north part of lot 12 in the sixth concession of Catharine township. A well defined narrow fracture has been traced by means of trenches from near the northwest corner of the property in a southeasterly direction across the claims. Along the strike several pits have been sunk, revealing narrow, sometimes parallel veins of quartz, averaging one or two inches in width, with the basalt along the veins showing alteration with iron pyrites a few inches from the wall. A small amount of copper pyrites occurs in the veins. Native gold was found in several pits by D. Campbell while samples over a width of four inches, taken by the writers, showed values in gold. The strike of the fracture is roughly that of the volcanic flows of the area.

Cotter.—The property consists of the two south claims in the north half of lot 12, in the sixth concession of Catharine. Trenching has been done on several quartz veins in the west part of the westerly claim and some diamond drilling has been done from the south boundary. The northerly vein, 9 chains north of the south boundary has been trenched for 11 chains. It strikes east and west, dips 60° N. and varies from 2 inches to 2 feet in width. The quartz is narrow, but the wall rock is altered to carbonate and contains iron pyrites and stringers of quartz. A similar but wider vein occurs in the southwest part of the claim, the quartz varying in width from 2 inches to one foot, while the wall rock is altered over a width of 3 feet. No underground work has been done on these veins.

Connell-McDonough (S. ½, lot 12, Concession VI, Catharine township).—The nearly flat vein on the Miller-Independence extends easterly to the Connell-McDonough where there has been considerable trenching along the strike of the vein. Native gold can be observed at several places along the footwall of the vein.

Kennedy-Boston.—The Kennedy-Boston Gold Mines includes the south half of lot 11, con. VI, Catharine township. The rocks are pillow and coarse-grained basic lavas together with narrow bands of felsitic and porphyritic acid rocks with a general N.W.-S.E. strike. A fracture has been traced 1,200 feet on the surface from near the northwest corner to the southeast. It is along the contact of a basic lava, with a light-coloured felsitic or porphyritic rock which lies to the southwest. A shaft, 600 feet from the west line, has been sunk on the fracture, the northeast wall of the shaft being on the contact which is nearly vertical. The mineralization occurs chiefly near the contact. At a depth of 50 feet in the shaft (Sept., 1919),

there is reddish greyish silicified vein material carrying pyrite and copper pyrites in fine grains with occasional showings of finely disseminated gold. Two faults, 3½ feet apart, were observed in the shaft to the south of the silicified zone, together with a narrow vein of reddish quartz carrying pyrites. The shaft was later sunk to the 150-foot level and 130 feet of drifting was done northwest and 80 feet southeast of the shaft. A strong fault was encountered 80 feet west of the shaft that displaced the vein to the south.

Catharine Gold.—This property, which is controlled by Geo. and J. Tough, is situated in the north half of lot 10, concession IV, Catharine township. On the north boundary a 12-foot pit is sunk on an altered grey feld-spar-porphyry dike about 13 feet wide and striking N.E.-S.W. The porphyry contains a network of quartz stringers some of which carry quite coarse gold showings. Iron pyrites and tourmaline occur in the narrow quartz stringers. The Keewatin pillow lavas adjoining the porphyry are impregnated with carbonate.

Burnand-Gzowski.—The porphyry dike and probably the gold-bearing quartz veinlets which the Catharine Gold is working extend to the adjoining property, the Burnand-Gzowski, which comprises the south half of lot 10 in the fifth concession of Catharine township.

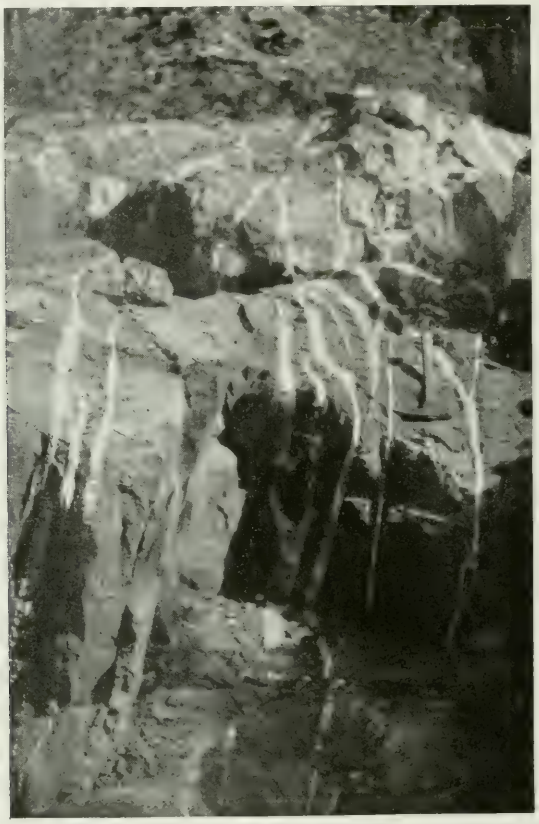
Ostrum (N.W. ¼, N. ½, lot 8, concession III, Catharine township).—Gold to the value of $1 and $2 per ton can be obtained on assay from quartz veins carrying pyrites and calcite in a light-coloured greenstone cut by a narrow quartz-porphyry dike.

Daley.—The claim comprises the S.W. ¼ S. ½, lot 6, concession IV, Catharine township. Work has been done on a mineralized zone 250 feet southeasterly from No. 4 post. The rock is rusty weathering carbonate cut by numerous reticulated quartz stringers. The general strike is N. 40° W. and dip 80° N.E. A pit has been sunk to a depth of 12 feet and a long cut made in the mineralized deposit. Iron pyrites occurs abundantly together with some specularite in the deposit.

Walsh-Taylor (N.E. ¼, S. ½, lot 5, concession III, Catharine township).—An inclined shaft has been sunk to a depth of 30 feet on rusty carbonate containing quartz veins. The deposit, which contains considerable iron pyrites and brown and green iron carbonates, strikes 30° south of east and dips about 45° to the northeast. A sample of selected material from the dump yielded $4.80 in gold per ton. During 1921, a rich showing of gold was reported to have been made on the southern part of the claim.

Roger-Barnett.—W. G. Roger and F. Barnett are prospecting a group of claims consisting of the N. ½ lot 5 and the west part of the N. ½ lot 4 in the second concession of Catharine township. The country rock is basalt and diabase with a few narrow feldspar-porphyry dikes. The basalt shows pillow structure and, at times, is spherulitic. In places the basalt and diabase have been replaced by carbonate, a grey rock which is rusty weathering on the surface. Through the altered rock there are a number of quartz veins on most of which work has been done.

The main workings are in the westerly part of the property on lot 5, where a mineralized zone has been trenched in a direction of N. 25° E. for 500 feet. In this zone, which averages 10 feet in width there are numerous stringers of quartz from half an inch to a foot in width running diagonally in a direction N. 18° W. across the altered basalt, now rusty carbonate. The cross stringers of quartz in many places show visible gold, while iron pyrites are present in the quartz and altered rock near the veins. The veinlets are not sufficiently close together in most of the deposit to be mined in one large mass. In one part of the deposit there are



Irregular stringers of quartz in rusty weathering altered basalt, Roger-Barnett claim, Catharine township.

irregular quartz veins which are roughly parallel with the general strike, and from these there are narrow quartz veinlets running toward the walls. Some coarse gold was observed in the quartz veinlets. Several pits and cross-cuts have been made on the deposit which generally resembles a stockwork.

A strong quartz vein from 3 to 10 feet wide strikes N.E. and S.W. across the line between 4 and 5. It occurs in the spherulitic lava and, as far as explained, has shown only low gold content.

In the vicinity of this vein some spherulitic lava contains stringers of quartz, while the lava contains spots of iron pyrites. A sample of the mineralized lava showed some gold on assay.

Hounslow.—On the Hounslow location, S. ½, lot 4, concession I, Catharine township, is a deposit quite similar in appearance to the Roger Barnett. Coarse gold occurs in four quartz stringers. Between each two stringers is about a foot of basalt altering to a grey rusty weathering carbonate. The veins strike north and and south and dip 60° E. About 20 feet east is a parallel vein system in which is a quartz vein 100 feet long and 6 inches in width.

Skead Township

Skead Gold.—Since the spring of 1920, the Skead Gold Mines, Limited has had about 20 men, under the direction of M. L. Bouzan, prospecting 55 mining claims in various parts of Skead township. Encouraging results are being obtained to the west of St. Anthony lake on claims L.S. 29 and L.S. 30 in lot 20 of the second concession. On L.S. 29 three shafts have been sunk to depths of 50, 14 and 50 feet on three parallel quartz veins which strike N. 10° E. and dip 60° to 85° easterly. The veins occur in a light grey-coloured andesitic rock which is intruded by an occasional dike of feldspar-porphyry. Some visible gold was found in the central vein near the surface while sinking the shaft. The

Narrow quartz vein with stringers of quartz in hanging-wall, Skead Gold property.

quartz contains much iron pyrites and, in places, thin seams of molybdenite. Some selected material from the dump at the central vein gave on assay $4.00 in gold per ton.

In 1921, a number of narrow veins, quite unlike those just described, were discovered on claim L.S. 30 which corners on L.S. 29 to the north-west and extending easterly on claim L7970. These veins, which are roughly parallel in an east-west direction, vary from one inch to twelve inches in width and have been traced 600 feet or more. They carry iron pyrites, copper pyrites and specularite with little or no quartz. From these narrow veins high assays have been obtained varying from $9.00 to $75.00 in gold per ton. The veins, however, are not closely spaced, eight having been found in a width of 250 feet at the time of inspection in October, 1921. The andesite and porphyry adjacent to these narrow

sulphide seams have been fractured in places over a width of 8 or 10 inches and the cracks filled with specularite and sulphides. Additional work may reveal wider veins.

A number of pits have been sunk on the veins and a few tons of iron and copper pyrite and specular hematite obtained which were shipped to the provincially owned Timiskaming Testing Laboratory at Cobalt for experimental work. It was found that oil flotation would successfully concentrate the copper after which the gold could be recovered by cyanidation. The higher values appear to come from those specimens which contain considerable pyrite. The company is installing a plant, consisting of boiler, hoist and 4-drill compressor, and intends sinking a shaft and exploring the veins at depth.

On the west side of L.S. 30 a number of pits have been sunk on a quartz vein with strike N.E. and S.W. The quartz is banded and contains iron pyrites, molybdenite, and shows some gold on assay.

The company has also done exploration work on several claims east of St. Anthony lake. On claim 313 an open cut was made on light-coloured felsite carrying iregular stringers of quartz with calcite and a little iron pyrites. On claim 6722, a pit was sunk on stringers of quartz carrying calcite, epidote, red feldspar and iron pyrites. The irregular quartz stringers have a general strike of north and south and occur in diabase.

Telluride Syndicate.—This syndicate has several claims in the south-west part of Skead township. On claim 8846, in lot 2, concession III, a vein with chalcopyrite, iron pyrites and specular hematite, similar to the veins on the Skead-Gold, has been uncovered for a length of 200 feet. The vein strikes N. 60° E., and is from one to three inches in width and shows the presence of considerable gold on analysis.

Nigger (M.R.3.).—This 80 acre claim was surveyed prior to the subdivision of the township of Skead in 1908. The rocks are largely Keewatin dacite and andesite. A few pits have been sunk on narrow N.E.-S.W. bands of iron pyrites containing a little copper pyrites and specular hematite. One such sample gave on assay: silver, none; nickel, none; platinum, none; and gold, $15.60 per ton.

Flanagan.—P. Flanagan has done some development work on several claims in the south part of lot 7, concession III, Skead township, to the east of St Anthony lake; the principal claims are 4927 and 6593. A quartz vein having an east-west strike has been found in a white weathering coarse-grained quartz-diorite porphyry. A shallow pit on claim 4927 exposes a quartz vein 13 inches wide and dipping 80° S. The quartz is somewhat banded and carries fine-grained iron pyrites. A picked sample showed $3.20 gold per ton. The vein, faulted 75 feet to the south, has been followed easterly to claim 6593. At one point it is four feet in width. At the extreme easterly exposure of the vein it is 3 inches wide and carries iron pyrites, copper pyrites, a little galena and a telluride. The vein and quartz-diorite-porphyry are concealed for several chains by a bed of conglomerate of the Cobalt series, 10 feet in thickness. The conglomerate was deposited on the eroded surface of the older rock which carried the vein.

Work has been done by Mr. Flanagan on claim 7675 in lot 4, concession II Skead township, to the west of St. Anthony lake. A pit was sunk on a quartz vein carrying abundant iron pyrites which occurs along or near the contact of a quartz-porphyry and light-coloured felsitic rock.

On the road west of St. Anthony lake, on claim 8937, in lot 4, concession II, the Flanagan Bros. have uncovered a quartz vein for a length of 150 or more feet in Keewatin felsite. The vein strikes 20° west of north, dips 60° west and varies in width from 2 to 4 feet. Gold can be obtained on panning. One channel sample across 3 feet yielded on assay 60 cents in gold per ton. The quartz is much fractured and contains iron and copper pyrites.

On the Smith-Flanagan claims, L.S. 364 and 365, in lot 6, concessions I and II, Skead township, is a quartz vein from one foot to 6 inches in width and carrying much chalcopyrite. The vein occurs in Keewatin felsite and an intrusive feldspar-porphyry. One sample, on analysis, yielded $5.20 gold per ton.

On claim 7861, immediately south of C.E. 4, in lot 5, concession VI, Skead township, small amounts of gold were reported to have been obtained on analysis from a stockwork of quartz in a red porphyritic hornblende syenite. Small amounts of pyrite, chalcopyrite, galena and green talc were observed.

Fidelity.—The Fidelity property is situated directly northeast of St. Anthony lake in concession IV and V. The north part consists of basic lavas and serpentine with narrow bands of iron formation and dikes of lamprophyre and porphyry.

On claim 238 a shaft has been sunk to a depth of 28 feet on a band of black chert carrying some stringers of quartz with iron pyrites and copper pyrites. Some visible gold was obtained in sinking the shaft. Just north of the shaft the chert band, which strikes N. 10° W., is two feet wide. Cutting the basic lavas and running into the shaft are two lamprophyre dikes 6 inches and one foot in width.

Exploratory work, consisting of stripping and shallow pits, has been done on several bands of iron formation, which consist of contorted layers of silica and magnetite with some hematite. These bands are cut by irregular cross veinlets of quartz in which there is iron pyrites while massive iron pyrites occurs in the iron formation. One band, with strike N. 15° W., from 8 to 20 feet wide crosses the concession line on claims L.S.11 and 6590. Assays have shown the presence of low gold values from several pits. In one pit on claim 463 a lenticular mass of iron pyrites in the iron formation has a width of one foot.

On claim L.S. 11 there is also a mass of light-coloured volcanic rock that is intersected by quartz veinlets. The rock and veinlets carry a little iron pyrites from which assays of two or three dollars have been obtained. Three shallow pits have been made on this mineralized rock.

Barry Webster.—The Webster property is situated in the south half of lot 7, concession V, Skead township. No work was being done at the time of the visit, but some work was found on a narrow band of chert with strike N. 60° W. in the basalt. The chert in places carries streaks of iron pyrites and pyrrhotite on which a shallow pit was sunk. A sample of the mineralized chert showed no gold and a trace of nickel. The owners report that on another part of the property some gold-bearing material was found.

Zenith.—The Zenith Gold property is situated in the northwest corner of Skead township on claim 6202. A shaft was sunk to a depth of 20 feet on a quartz vein, varying from 3 inches to a foot in width, which strikes east and west. The vein occurs in green schist near the contact with a narrow band of porphyry. A. Johnson, in charge, stated that a little visible gold was obtained in the shaft. A pit was sunk on a series of porphyry and lamprophyre dikes striking N. 66° W. on claim 7115. Two porphyry dikes, 2 feet and 3 feet wide, are well mineralized with iron pyrites, but a sample from there showed no gold.

Cook.—The Cook claims, Nos. 3943, 4041, 6743 and 6741, are situated along the boundary between the townships of Hearst and Skead. The rocks consist of bands of rusty weathered carbonate, green schist and sediments intruded by porphyry of which the general strike is N. 35° W. Most work has been done in Hearst township near the boundary line on claim 3943. Here the white weathering porphyry and the rusty carbonate are traversed by numerous stringers of quartz striking N. 38° E. and varying from an inch to a foot in width. The cross stringers are in places connected by other stringers, affording a stockwork structure. The quartz carries in places iron and copper pyrites and the carbonate carries some pyrite near the quartz veinlets. One pit has been sunk eight feet in carbonate. A sample from the pit, across a number of stringers of quartz and carbonate over a width of 4½ feet, was found to carry $6.80 in gold per ton. A selected sample of quartz with sulphides from one vein 4 inches wide showed $14.80 in gold per ton. Several shallow pits have been made along the strike of the carbonate and porphyry for a distance of 100 feet.

Lincoln-Nipissing (C.E. 3.—C.E. 4)—The deposits are stockworks, namely: ferruginous dolomite and porphyry containing considerable pyrite and irregularly cut by quartz veinlets. "Some work has been done on claim C.E.3, consisting of a few cuts, and a shaft, the depth of which was not ascertained owing to the water which it contained when visited" in 1909 by M. E. Wilson.[1] No additional work has been done since 1909.

Manley-O'Reilly.—A specular visible gold showing was made in the autumn of 1919 by Walter Manley on the Manley-O'Reilly claim L.S. 128, lot 6, concession VI, Skead township. Considerable gold in very fine particles occurs on a slickensided contact between quartz-porphyry and a narrow band of greenish carbonate carrying numerous cubes of iron pyrites and some serpentine and quartz particles. Some gold also occurs in seams in the green carbonate distant a few inches from the gold-bearing contact. Two similar carbonate bands, 6 inches in width, lie a few feet northeast of the gold-bearing carbonate. The 12-foot quartz-feldspar-porphyry dike and ferruginous dolomite adjoining the gold showing are intersected by numerous quartz veinlets which carry some iron pyrites and a little galena. A similar assemblage of porphyry, quartz and green carbonate bands occur along the same strike across a clay flat 200 yards to the southeast. A diamond-drilling programme is outlined for 1922.

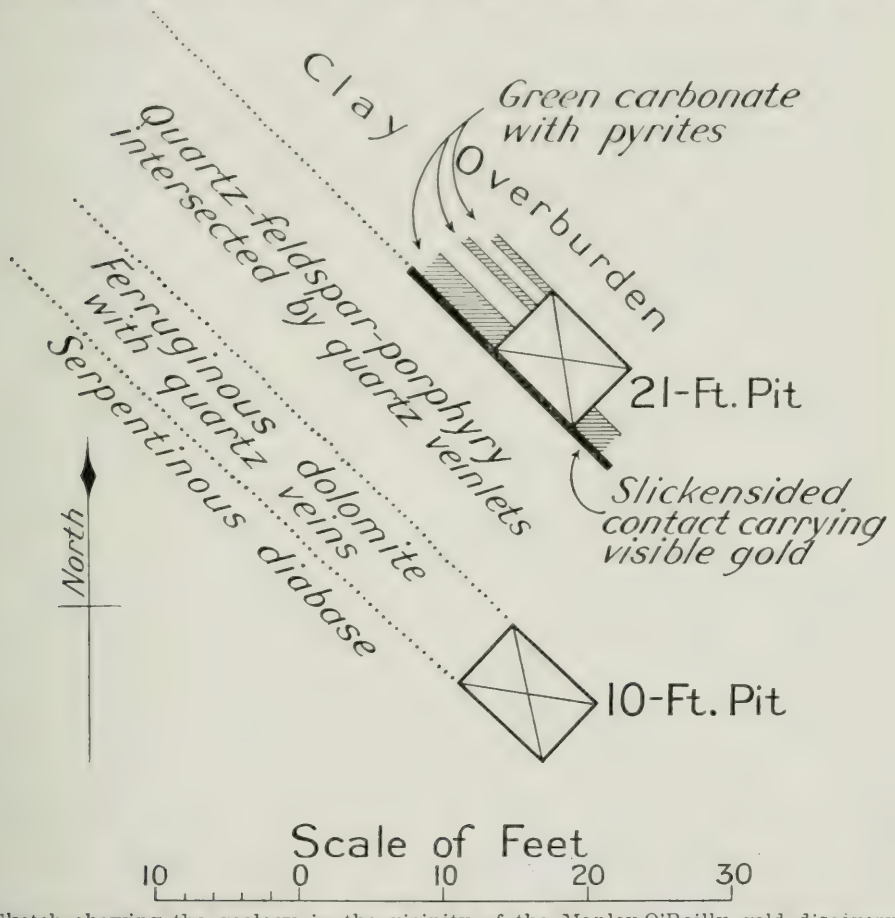
Martin.—In the southwest corner of the Martin claim, No. 6263 on lot 9, concession VI, Skead township, is a cylindrical mass of porphyry about 100 feet in diameter and apparently surrounded by Keewatin pillow lava. The porphyry contains a network of quartz veinlets and lenses of quartz up to several feet in width carrying much pyrite and some galena. Visible gold was reported to have been found. A chipped sample across 20 feet yielded 40 cents in gold to the ton. The work comprised a shaft and some open cuts.

Crawford-Skead.—The Crawford-Skead property consists of two claims in the north parts of lots 9 and 10, concession V, Skead. A shaft has been sunk to a depth of 22 feet on the contact of red porphyry and lamprophyre. Along the contact there is a silicified zone which carries abundant fine-grained iron pyrites for a width of 26 inches at the east end of the shaft. Some molybdenite occurs along slickensided fractures in the quartz. The porphyry near the contact also carries abundant iron pyrites. A sample 26 inches wide of silicified

[1] Geol. Sur. Canada, Memoir 17 E., p. 55.

material, with pyrite lying between porphyry and lamprophyre, gave 40 cents in gold per ton. The general country rock is an altered sediment.

Wisconsin-Skead (Claims Nos. 1352, 1353, 1354, and 1406 on lot 10, concessions V. and VI., Skead township).—Crossing these claims in a northwest-southeast direction is a massive pink biotite granite, porphyritic in places and about 100 feet in width with Keewatin greenstone and Timiskamian sediments on the sides. Crossing the granite dike at right angles to its longer dimension on claim 1353, where practically all development work has been done, are numerous parallel quartz veins which all dip about 40° south. These veins are usually an inch or so in width, although veins Nos. 6 and 11 are approximately 3 and 6 feet wide respectively, and contain some visible gold and a telluride. No vein was

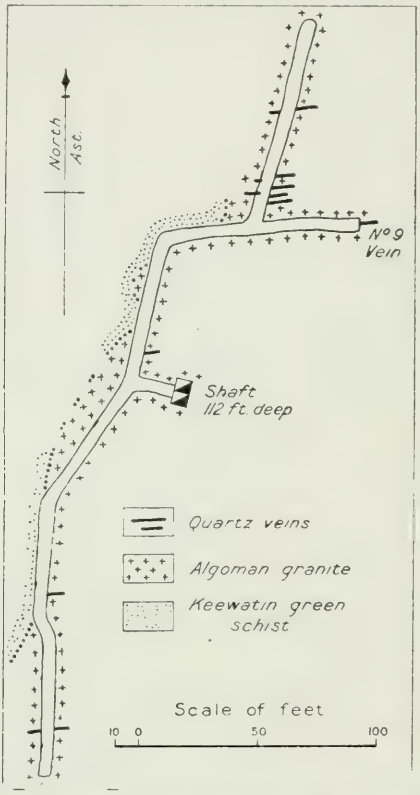


Sketch showing the geology in the vicinity of the Manley-O'Reilly gold discovery.

seen extending from the granite into the adjoining wall rocks. A shaft has been sunk vertically in the granite to a depth of 112 feet exposing numerous quartz veinlets dipping about 40° south. On the 110-foot level about 1,000 feet of lateral work has been done. No. 6 vein occurs along a fault which contains quartz, calcite, pink barite, pyrite, molybdenite, gold and a telluride. The No. 11 vein had not been reached in the cross-cut when the workings were examined in March, 1920. In May, 1921, the shaft was full of water. Much diamond-drilling has also been done. The property has been cleared of the forest: a steam compressor and good

buildings have been erected. The company intends obtaining hydro-electric power from the Raven Falls power plant, for further development.

Sampson (Claims Nos. 4363 and 4364 on lot 10, concession VI, Skead township).—These claims lie directly north of the Wisconsin-Skead. Work consists of trenching and test-pitting. Gold has been found in a stockwork of porphyry and quartz up to 100 feet in width. The quartz veins vary in width from 3 feet to a fraction of an inch in thickness and carry pyrite, molybdenite, telluride and gold. A grab sample, from a seam 4 inches wide and containing much pyrite, molybdenite and molybdite, assayed $14.80 in gold per ton.



Plan of 100-foot level. Wisconsin-Skead property, March, 1920.
Most of the veins dip from 30° to 45° south.

De Villiers-McBurke.—Gold was reported to have been found on May 17th, 1921, on the northwest corner of Rattray township on the unsurveyed claim No. 9168. The vein was examined two days later, but the owners had no gold that could be seen in place. The vein is composed of glassy quartz, occasionally smoky in character and containing a little pyrite and galena. In places considerable rusty carbonate is interbanded with the quartz. The vein had been uncovered, at intervals, for 1,700 feet in a north and south direction. The vein is 10 feet wide in places and apparently dips 85° to the west. The enclosing rocks are Timiskamian greywacké schists impregnated with pyrite, and quartz-porphyry.

Gold is reported to have been found on various other locations in Skead township. They are as follows: Mutton (claim No 6711 in lot 4, concession III); Kearney (L.S. 214); Gorman (6830) and Boughmam (5004), the last three claims being the north parts of lots 7 and 8, concession V.

THE BLACK RIVER AREA

By D. G. H. Wright

Introduction

The following report, based on information obtained during a survey in the field season of 1920, deals with the geology and economic possibilities of an area in the District of Timiskaming, north of and contiguous to the Kirkland Lake area[1] and west of the Ben Nevis area[2]. The character and age of the rocks in the area were known in a general way to be similar to those in the adjoining townships already geologically surveyed. Little detailed information, as to character of the country, geology, economic possibilities or travel routes, had been collected.

With such limited time available for the work—nine townships, approximately 325 square miles being covered in the season—detailed examination was neither attempted nor possible. For this reason the report must be considered as presenting only the geological generalities, supplemented by more detailed work in parts where considerable staking had been done or rock formations warranted it.

The mapping of the lakes and rivers was done by means of a split-objective lens micrometer and prismatic compass, using the various township boundaries as control. Closed traverses were made wherever possible. The inland traverses were made by pacing and compass methods and small lakes intercepted on these traverses were sketched by taking compass bearings on prominent points and estimating the distances.

Acknowledgments

The writer was efficiently assisted in the field by E. Howell, D. E. Kerr-Lawson and R. Presgrave.

The photomicrographs were kindly prepared by C. W. Knight, to whom thanks are also due for many suggestions as to the geological mapping of the area and assistance in the compilation of this report.

The preparation of the geological maps and inserts accompanying this report was done by P. A. Jackson under the supervision of W. R. Rogers, topographer of the Ontario Department of Mines.

The chemical analyses and assays were made by W. K. McNeill and T. E. Rothwell of the Provincial Assay Office.

Thanks are due to many prospectors who tendered much information which aided materially in the field work. It is particularly desired to thank V. Woollings of Thos. S. Woollings Co., Ltd., for many courtesies shown the party while in Black township and vicinity.

Thanks are also due H. George Ginn, Mining Recorder, Swastika, for blue prints and information provided.

Maps

The report is accompanied by a geological map, No. 30c, scale one mile to the inch. In the general arrangement of the map, the plan, initiated by C. W. Knight in his map of the Ben Nevis area,[3] has been followed, the dotted lines showing the

[1] Kirkland Lake Gold Area, Ont. Dept. Mines Report, Vol. 29, Part IV, 1920; also Vol. 28, Part II.

[2] Ont. Dept. Mines, Vol. 29, 1920, Part III, Ben Nevis Gold Area.

[3] Map No. 29c, accompanying Ont. Dept. Mines Report, Vol. 29, 1920., Part III.

country traversed in the section work. As most of the lakes and rivers of the area had not been surveyed previously, much of the time spent in the field was occupied in topographical work.

The following maps have been utilized in the preparation of the map of the Black River Area:

(1) The eastern boundary of Bisley and Morrissette township taken from map No. 29 e, Ben Nevis gold area, by C. W. Knight, Ontario Dept. of Mines Report, 1920, Vol. 29, Part III.

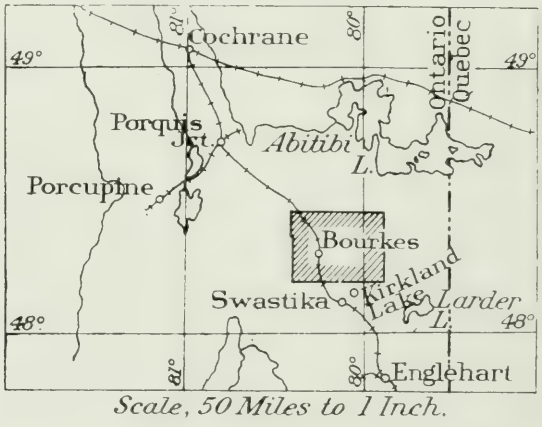
(2) The Goodfish Lake Area taken from map No. 25 f. by A. G. Burrows and P. E. Hopkins, Ontario Bureau of Mines Report, 1916, Vol. 25, part I.

(3) The southern boundary of Bernhardt and Morrissette from map of Kirkland Lake and Swastika Gold Areas by A. G. Burrows and P. E. Hopkins, Ontario Bureau of Mines Report, 1913, Vol. 23, part II.

(4) The township of Maisonville extracted *in toto* from map No. 23b, by A. G. Burrows and P. E. Hopkins, Ontario Bureau of Mines Report, 1914, Vol. 23, part II.

(5) The northern boundary of Barnet and Thackeray townships from map No. 28b, accompanying Ontario Bureau of Mines Report 1919, Vol. 28, part II.

(6) Topographical features of Lee township were largely supplied by S. Woollings, who has timber cruised this township.



Index map showing location of the Black River Area (hatched) in relation to Porcupine and Kirkland Lake.

Location

The area described comprises the following townships: Cook, Barnet, Thackeray, Bisley, Melba, Benoit, Black, Lee, Bernhardt and Morrissette. Since all of this area with the exception of the southern portion of Bernhardt and Morrissette is drained by the Black river and its tributaries, it has been named for the purposes of this report "The Black River Area." The position of the area with respect to adjacent localities is indicated in the accompanying index map. Black river is a tributary of the Abitibi, and joins the latter in the township of Walker at a point about six miles east of Porquis Junction on the T. and N.O. railway.

Accessibility

The western portion is traversed by the Temiskaming and Northern Ontario Railroad. The southeastern part is best reached by way of Swastika from thence by stage to Kirkland lake; by canoe route from Kirkland lake, Bernhardt and the southwest portion of Morrissette township is accessible.

White Clay and Woollings creeks, which empty into Meyers lake, make the interior of Lee and Black townships, accessible by canoe. White Clay creek is not navigable in low water, and even in high water navigation is made difficult by the swamp alders which overhang the banks. Canoe travel on Woollings creek was possible even during the dry season experienced in the summer of 1920. A canoe route, free from portages, leads to Meyers lake from Bourkes on the T. and N.O. railway. From Bourkes the route follows the White Clay river, traverses Lower Twin and Swan lakes and then follows White Clay creek northward into Meyers lake.

The balance of the area is accessible from Scotties Springs,[1] a flag station on the Temiskaming and Northern Ontario railroad, at a point where the Black river parallels the railroad about five miles north of Bourkes. The Black river is navigable with little difficulty into Morrissette township. More will appear under the various townships regarding their respective accessibility.

Early Prospecting and Historic Notes

Shortly after the discovery of the silver bearing veins at Cobalt in 1903 this area was prospected for silver, and old workings were met with in various places, but particularly in Benoit, Black and Barnet townships.

In 1912 gold discoveries were made in the vicinity of Goodfish Lake. In 1916 discoveries of gold promising to be of economic importance, were made in the vicinity of Bourkes by A. Skjonsbye, Oscar Anderson, A. Wickstead, and others. These two localities are still promising and contain many prospects which require more development before any pronouncements can be made as to their economic value.

Thackeray township also boasts of its gold rush, and considerable prospecting was done by the Howey brothers, D. Willans, W. Cochenour and others, but no spectacular finds were made. As a result nothing further has been done in this locality.

The finding of a flint arrowhead on the north shore of Splashwater Lake, in Bernhardt township, caused the writer to inquire into the early Indian occupation of this area, as it was not thought that the Indians penetrated so far inland from recognized travel routes in arrowhead days. Dr. R. B. Orr,[2] when questioned relative to the early Indian occupation, volunteered the information that this area was occupied by Algonquin tribes, chiefly by the Abitibi, as early as the 17th century. Historical records tell of an expedition of the Iroquois sometime in the 17th century as far as Iroquois Falls, where they met and defeated the Abitibi. Shortly after the French occupation the Abitibi discontinued the manufacture of flint artifacts, as they readily accustomed themselves to new conditions. The finding of the arrowhead, above referred to, points to Indians penetrating even this remote part of our Province prior to the French occupation.

Previous Geological Work

The only previous geological work accomplished in the area, other than along some of the township boundaries done in conjunction with the work in adjacent areas, was that of A. G. Burrows[3] in the vicinity of Bourkes, and that of A. G. Burrows and P. E. Hopkins, in the Goodfish Lake Gold Area.[4]

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[1] Since called Yorkston station, Scotties Springs P.O.

[2] Director Provincial Museum, Normal School Bldg., Toronto.

[3] Gold Bearing Veins of Benoit Township, Ont. Bur. Mines Report, Vol. 26, 1917, pp. 248-251.

[4] Goodfish Lake Gold Area, Ont. Bur. Mines Report, Vol. 25, pp. 260-263.

Topography and Physiography

The Black River area saddles the divide between the Hudson Bay slope and the drainage basin of the St. Lawrence river. The greater portion lies to the north of this height of land. The area has an average elevation of 1000 ft. above sea level with hills and ridges rising here and there to elevations seldom in excess of 350 feet above the surrounding country. A bench mark about one quarter of a mile north of Bourkes on the Temiskaming and Northern Ontario railroad records an elevation of 1011.92 feet. Goodfish lake is approximately 1025 feet above sea level.

The principal points of high elevation in the area consist of volcanics of the Keewatin series. Practically the only exceptions are ridges of the Cobalt series, which may be seen in the southwest of Benoit township and also in Black township. The high, hump-shaped, northern outlier of the Cobalt series—Defiance Peak—west of Butler lake is a typical example. The highest hill in the area is possibly the one rising to a height of 350 feet above the surrounding country situated one mile north of the southwest corner of Cook township. Lava Flow mountain, in lots nine and ten in the fifth concession of Cook township, is approximately 175 feet in height. It has the outline of an old volcanic cone. From Blue mountain which rises 200

Looking north at "Lava Flow" mountain, Cook township.

feet in the northwest of Bernhardt, and also from the east to west ridge rising 150 feet with a precipitous face northward situated immediately south of the northwest corner of Melba township, commanding views of the surrounding country may be had. A wonderful view of the country stretching to the north, west and east for fifteen to twenty miles may be obtained from the last mentioned mountain. There are many other localities possessing prominent peaks, for example the central portion of Morrissette, the area southwest of Columbus lake in the same township and along the line between Bisley and Melba townships northward from the Black river which consists of a series of peaks from which one may view for miles the landscape typical of the Laurentian plateau region, spruce covered for the most part, but here and there dotted with patches of poplar and birch.

The area in common with all of the Laurentian plateau country has many lakes. These occur chiefly in the rocky, hilly country, particularly in Bernhardt and Black townships.

Amikougami lake is remarkable for its irregular shape, high rocky shores, numerous arms and islands, and the extent of its shore line. The series of lakes lying

north of Goodfish lake, east of the western boundary of Morrissette, being in sandy country are all remarkably clear and largely spring fed. Butler, Malloch and Verona lakes are sand bottomed and crystal clear. The first two named vary in depth from 20 to 40 feet. Soundings of 150 feet were obtained in Verona lake. The only other lake of outstanding features is Lauramay, situated in the southwest corner of Bisley township. Next to Amikougami it is the largest lake in the area, being about one and a half miles long from east to west and one half mile wide. It is dotted with rocky islands and surrounded on all sides by high hilly country, all of which make quite a picturesque setting. The other lakes of the area are for the most part shallow, weedy-edged bodies of murky water containing a considerable amount of organic matter in suspension.

High falls, Melba township, a series of cascades with a total drop of upwards of one hundred feet. The picture was taken from hilltop at foot of falls.

The Black river is the only stream of importance. Its source is south of the centre of Morrissette township, and it follows a sinuous course through swamp-land northward into Bisley township where its banks become higher as it flows through the clay land: then in a general westerly direction it meanders across Melba township into Benoit and Cook, where it broadens into a stream two to three chains wide with a depth of ten to fifteen feet, after its two main tributaries, the White Clay and the Little Black, have augmented its flow. The other streams and creeks of the area are neither wide nor deep and the largest of them are only navigable in the early summer or during a wet season.

Waterfalls

The area possesses several waterfalls, the principal one being High falls, situated on the Black river about the centre of Melba township. The total drop including the rapids at the foot of the falls approaches 100 feet and is made up of a series of cascades from eight to twenty five feet each. In June the volume of water passing over was not large, but a storage dam might make the falls worth harnessing for power purposes. Three other waterfalls of from 20 to 30 feet exist, one on the White Clay river in Benoit township about 30 chains east of mileage 185.5 on the Temiskaming and Northern Ontario railroad, another on the Little Black river in the northwest corner of Bernhardt and the other in the centre of Lee township on the creek which drains into the southwest of Meyers lake.

Glaciation

The effects of glaciation are noted everywhere throughout the region. Huge boulders have been left on the summit of the highest peaks. The processes of denudation and deposition resultant from the Labradorian ice sheet have created a youthful drainage system on a surface of low relief, producing the peculiar glacial physiography so typical of the pre-Cambrian Shield. The sand ridges of the region do not follow any general direction. For instance along the southern boundary of Thackeray the ridges run from north to south; in Cook township several prominent ridges have a northeast to southwest trend, and in the northwest corner of Black township, the alignment is from east to west.

A rather striking feature was noted in Cook township. On the slopes of Lava Flow mountain are terraces suggestive of ancient beaches. The boulders and pebbles are in step-like formation and there is an indication of sorting.

Fish and Game

Generally speaking fish are not plentiful throughout the area. The lakes of Bernhardt township are the most productive. Pickerel, pike, and whitefish are the most plentiful species. There are also a great number of suckers and white trout which are of little commercial value. The large amount of suspended material, both clay and organic matter, in nearly all of the lakes and streams make them an unsuitable environment for either trout or bass, but even in the lakes already referred to as having clear water these two species, which might be expected, are absent. The only fish in Butler lake, for example, were perch, and these rarely of edible size.

Moose were plentiful in the district particularly along the Black river in Melba township. A few red deer and caribou are reported to frequent Black and Lee townships. The intense trapping of the beaver during the recent open season has nearly exterminated this species. Only a few fresh beaver cuttings were seen by the party. The mink, the fox, the fisher, the lynx, the muskrat, the rabbit and the black bear are all inhabitants of this area, but are not numerous.

Ducks were not plentiful; each lake, however, had a few. Partridge were especially abundant.

Forests and Forest Fires

The forests are nearly all green, practically the only large belt of brulé being in Cook and Barnet townships which were swept by the Matheson fire in 1916. The northwest corner of Black township is all old brulé. The only fire of any size in 1920 swept along the Woollings camp road to the south of Malloch lake and crossed into Benoit township. No timber of merchantable size was lost in the fire.

The forest growth varies locally, the character of the country being the determining factor. Poplar, birch and balm of gilead border streams and lakes and timber the slopes or other areas where the drainage is good. The sand covered areas are timbered with jack (Banksian) pine. The low, poorly drained, clayey soil

produces a black spruce forest which if very wet has a fair percentage of tamarack. In rocky areas, a mixed forest growth of red, white and jack pine with considerable birch, poplar and black spruce exists. The low muskeg areas are covered with scrub spruce and tamarack. Cedar has not an extensive distribution in the area, only two localities of importance were noted, one in the northwest quarter of Black township and the other in Cook township.

Economically, the only trees of importance are the black spruce and poplar and these species are the most plentiful in the region. Spruce and poplar for pulpwood was being cut in Black, Lee, Benoit and Cook townships in 1920. The balance of the area possesses large reserves of these woods, which, as they become more accessible will provide a supply for the ever growing pulpwood industry. The jack pine in some localities grows straight and tall with a diameter of twelve to eighteen inches. In the vicinity of Malloch lake one jack pine having a girth of seventy odd inches, was cut for exhibition purposes. The year rings numbered 167 approximately. Doubtless much of the jack pine will some day be of commercial value for rough lumber, lathes or railway ties.

General Geology

The Black River area geologically is pre-Cambrian, the dominant rocks being basic lavas of Keewatin age.

Below is given the classification of the rocks and unconsolidated material referred to in the report and on the accompanying map, according to their relative ages. The oldest rocks are at the bottom of the table.

PLEISTOCENE.

GLACIAL AND RECENT:
Boulder clay, stratified clay, sand gravel, peat.

Unconformity

PRE-CAMBRIAN

KEWEENAWAN:
Diabase and gabbro.

Intrusive Contact

COBALT SERIES:
Conglomerate, arkose, greywacké, slate-like greywacké.

Unconformity

ALGOMAN:
Granite, syenite, grano-diorite, red and grey feldspar-porphyry, quartz-porphyry.

Intrusive Contact

PRE-ALGOMAN (HAILEYBURIAN):
Diabase and lamprophyre dikes and boss-like masses which intrude the Keewatin but the relationship to the Timiskaming series is unknown.

Intrusive Contact

TIMISKAMING SERIES:
Conglomerate, quartzite, greywacké and schistose derivatives, some of which may be Keewatin.

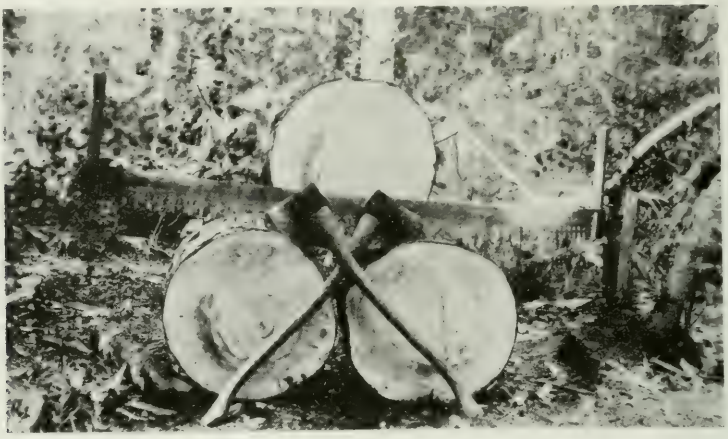
Unconformity

KEEWATIN:
Basic to acid rocks including basalt, diabase, andesite; grey, pillow and amygdaloidal lavas; tuffs and volcanic fragmental rocks.

Keewatin

Prior to the spring of 1918 geological investigation had not revealed the structure of the Keewatin series of Ontario. The Keewatin was regarded as a complex of igneous rocks of volcanic origin, devoid of regular geological sequence. In 1918 members of the staff of the Ontario Department of Mines [1] discovered and worked out an orderly succession of lava flows in Holloway township, comprising 14 distinct flows with a combined thickness of 4,400 feet. These flows have aided materially in giving a true conception of the Keewatin series.

[1] Abitibi-Night Hawk Gold Area, Ont. Bur. Mines, Vol. 28, Part II.



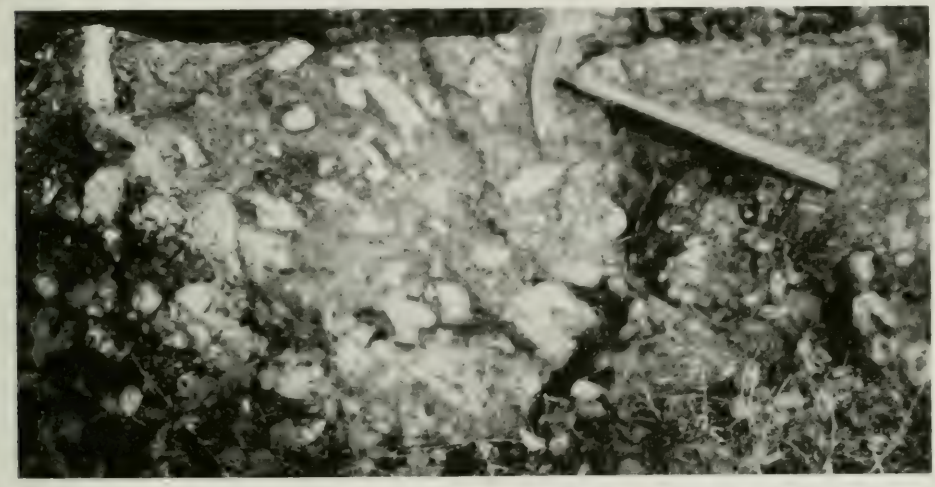
Jack pine cut for exhibition purposes from Malloch lake, Black township. The girth is seventy odd inches and the year rings, roughly counted, numbered 167.

View showing the sharp dividing line between two lava flows, Cook township. The pick in foreground, and figure in distance are on the bottom of lava flow where it is frozen against the ropy fragmental surface of the preceding flow.

That the Holloway township lava flows are not merely a local structure in the Keewatin is substantiated by the fact that a similar succession of lava flows were found in Cook township about twenty-two miles west of Holloway, during our work in the summer of 1920. As the Cook township flows are considered typical of the Keewatin series of the Black River area, no unnecessary details of petrographic description will be given here. Suffice it to say that the rocks of the Keewatin series in this region are similar to those of like series in northern Ontario and Quebec already fully described by W. G. Miller, C. W. Knight, A. G. Burrows, W. H. Collins, M. E. Wilson and others.

Keewatin Lava Flows, Cook Township

The Cook township flows are located in the north half of lots eight, nine, and ten in the fourth concession, and lots seven, eight, nine, ten and eleven in the fifth concession of Cook township. The north to south section traversing these flows was run from the north half of lot ten in the fifth concession to the north half lot ten in the fourth concession, along a line a few chains east of the lot line.



Fragmental top of lava flow, Cook township.

The locality is accessible by canoe from Scotties Springs. The Black river is followed down stream for about two miles to the mouth of the creek outlet of Bolton lake. This creek is followed to Bolton lake; then the lake crossed to the northeast extremity where a small creek has its inlet. This creek is followed a short distance to the line between concessions three and four which is travelled to the southwest corner of lot ten in the fourth concession. The lot line is then taken northward for forty-six chains. To the north and east of this point are the lava flows.

A brief resumé of the principal lava flows of the world ranging in age from Pre-Cambrian to geologically recent, was given by C. W. Knight,[1] in connection with his description of the Holloway township flows and the reader's attention is directed to this report for a better understanding of the following detailed discussion of the Cook township lava flows.

The belief of the most eminent geologists is that fissure eruptions (both the Holloway and Cook townships flows are classed in this type) played a more important role in the formation of lava flows than did the volcanoes. The absence of

[1] Ont. Bur. Mines Report, Vol. 28, 1919, Part II, pp. 17-19.

volcanic necks in areas where vast and ponderous sheets of lava appear furnishes a basis for the theory of fissure origin.

The Cook township lava flows as worked out, have a total thickness of 7,300 feet and comprise at least fourteen distinct flows, or the same number as in the township of Holloway. More detailed work may reveal the presence of even more, for it was noted that the ropy fragmental tops of the flows disintegrated more readily under weathering processes and hence it may be surmised that the drift covered areas are more likely to conceal a flow top, than a flow centre. It is not desired to give the impression that these flows are local, for throughout the Black River area there is a widespread distribution of pillow lavas, amygdaloidal basalts, and other rocks possessing the specific characteristics of lava flows. For this reason it is thought that the Keewatin formation in the entire Black River area represents a succession of lava flows, the structure of which is at present obscure, owing to the overburden. The locality of the Cook township lava flows has been burned over, and thus the rocks are laid bare revealing the structure in a remarkable manner. The flows have been tilted up from a horizontal position to one approaching the vertical. The upturned edges of the flows have an average strike of north 83° east astronomic, and a dip to the north of 80°.[1]

An interesting fact about the strike of these flows is that a continuation of their line of strike would approximately join the Holloway lava flows.

The lateral (east to west) extent of the flows was not worked out owing to the limited time at our disposal. A section near the southern limit of the exposure was run eastward from the line between lots ten and eleven for one and a quarter miles along the dividing line between the top of one flow and the bottom of the succeeding flow. The dividing line was continuous and well marked throughout, except, of course, where it was concealed by drift. Along the foregoing section several dikes were observed to cut the lava flows. The location of three of these dikes is given below:

(a) 600 feet east of the lot line a diabase dike 40 feet wide, striking N. 40 E. magnetic.

(b) 2950 feet east of the lot line diorite porphyry dike 10 feet wide striking N.W. approximately.

(c) 5500 feet east of the lot line numerous gabbro dikes cut the flows for 100 feet of their lateral extent.

Before proceeding with a description of these flows it is deemed advisable to explain the scope of some of the various terms used. The term basalt includes the dense basic igneous rocks of a green color. The term "grey lava"[2] refers to those grey coloured, fine-grained lavas which may have an intermediate composition between rhyolites on the one hand and basalts on the other.

It is highly probable that other rocks are included in these two classes such as trachytes, dacites, quartz-porphyries and andesites, but for the purpose of this discussion the foregoing broad classification will suffice.

In the brief summary of the flows which is given below the oldest is No. 1, and occurs at the northern extremity of the outcrop; proceeding south younger and still younger flows are met with.

Flow No. 1.—This flow is the most northerly worked out, although indications of distinct flow structures were observed north of this point on the west boundary of the township. The flow has an exposed thickness of 350 feet. The bottom is not discernible because at the northern exposed limit, the basalt, which is the characteristic rock of the bottom and central portions of the flows, disappears in a spruce

[1] The Holloway township flows dip to the south 80 deg. and strike a few degrees south of west, astronomic.—Ont. Bur. Mines Report, Vol. 28, Part II, p. 10.

[2] C. W. Knight, Ont. Bur. of Mines Report, Vol. 29, Part III, p. 26.

swamp. The top has a thickness of 30 feet comprising ropy, slaggy, fragmental material in which incipient pillow structure is developed.

Flow No. 2.—This flow has a depth of 875 feet, and may possibly include more than one flow, as part of it is drift covered. The ropy fragmental top is but 10 feet thick which tends to confirm this conjecture. Two shear zones which have been infiltrated with quartz and calcite exist near its base and test pits have been sunk on these but apparently they failed to reveal minerals of economic importance. This flow has a porphyritic development running in bands, almost dike like, one 20 feet and another 160 feet from the surface. The porphyritic bands are each 20 feet wide.

Flow No. 3.—This is a thin flow of 60 feet having a 25 foot top of ropy, volcanic, fragmental material. At the base the flow has a porphyritic texture, but the phenocrysts are not as plentiful as in the preceding flow.

Flow No. 4.—This flow has an apparent total thickness of 635 feet, a 30 foot ropy, fragmental top, and below this a development of pillow structure for about 300 feet. Another belt of pillow lava is developed to 100 feet from the bottom. A porphyritic texture is assumed ten feet from the bottom. The plagioclase feldspar phenocrysts are sparsely scattered through a basaltic ground mass.

Flow No. 5.—The depth of flow No. 5. is 500 feet of which 35 feet constitutes a top of volcanic fragmental material possessing a ropy and incipient pillow lava structure. Below the top for two hundred feet pillow lava structure is developed, and then basalt, assuming towards the centre a granitoid to diabasic texture.

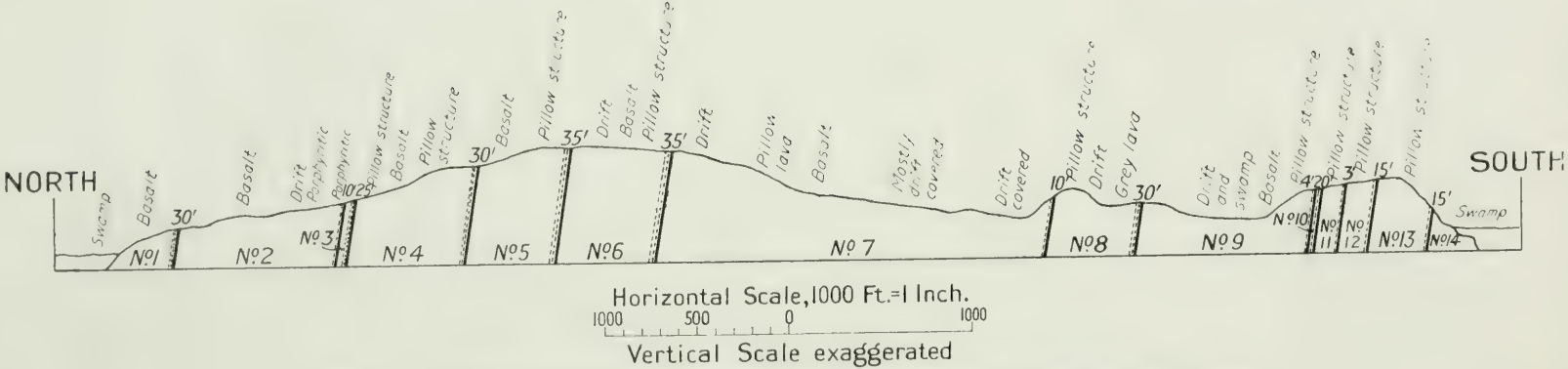
Flow No. 6.—This flow has a 40 foot top of ropy, fragmental material and a total thickness of 540 feet. As 150 feet of this is drift covered, there is a possiblity that this may comprise more than one flow. Below the ropy surface to a depth of 200 feet there is a wonderful development of pillow structure. Many of the pillows show a concentric structure of alternate bands of spherulites and basalt. Where it is frozen against the top of flow No. 5 there is a 10-foot belt of pillow lava.

Flow No. 7.—Drift, sand, and swamp cover this flow in various places and consequently it is possible that more than one flow is included. The apparent thickness is 2120 feet. The thickness of the possible top is only 10 feet, a fact which would point to a thin rather than a thick flow. About the centre of this flow there exists a shear zone 10 feet wide. Here the basalt has become quite schistose and much altered. In places the flow becomes less basic, resembling a grey lava with flow lines.

Flow No. 8.—The total thickness of this flow is 490 feet. The surface extends to a depth of 30 feet and consists of volcanic fragmental material having slag-like inclusions and showing the usual ropy, incipient pillow lava structure. Below the surface is a belt 125 feet thick of grey lava. Surfacing the ropy top of this flow is a 15 inch band of light green chert-like rock which shows distinct bedding. This is probably a silicified tuff, as under the microscope a thin section shows it to be an aggregate of fine angular particles. This tuff may have settled through the condensation of water vapors which in all probability would be quite dense during an outpouring of lava such as this, or it may denote a sub-aqueous desposition. The narrow belt of silicified tuff is not continuous and caps the flow for only a little over a hundred feet.

Flow No. 9.—This flow has an apparent thickness of 930 feet but as 700 feet of this is covered with sand and swamp it is impossible to state definitely that this thickness comprises but one outpouring of lava. There is only 4 feet of ropy fragmental top indicative of a thinner flow.

Flow No. 10.—This flow was only considered as a possible one owing to the fact that there was a depth of but ten feet of amygdaloidal basalt topped with



VERTICAL SECTION THROUGH COOK TOWNSHIP LAVA FLOWS, SHOWING 14 BASALTIC LAVA FLOWS.

Heavy lines denote contact between lava flows. The flows are numbered 1 to 14, commencing at the north end. The numbers 30, 10, 25, etc., denote the thickness of the fragmental top. The oldest flows are at the north, successively younger flows occurring to the south.

a thickness of fifteen feet of ropy, volcanic fragmental material. No pillow lava structure was observed.

Flow No. 11.—This flow has a total thickness of 120 feet and a ropy surface to a depth of 3 feet. No pillow lava structure was observed.

Flow No. 12.—This flow has a total thickness of 165 feet and a 15 foot top of ropy, fragmental material. No pillow structure was seen, other than the incipient pillow structure characteristic of the tops of all the flows observed. The bottom of the flow, like its predecessors, is basalt grading to a gabbro near the centre of the flow.

Flow No. 13.—This flow has a thickness of 310 feet, 15 feet of which constitutes the volcanic fragmental top. The flow has a considerable thickness of pillow lava. The pillows show a concentric structure of basalt alternating with spherulites. Eighty feet from the surface of the flow is a layer of porphyritic lava containing phenocrysts ranging in size up to three quarters of an inch in diameter. The phenocrysts weather white, producing a leopard-like appearance.

Flow No. 14.—Only 20 feet of the basaltic bottom of this flow is exposed before the outcrop disappears in a swamp.

Description of Bottom of Flows

The immediate bottom of the flows is a basalt, fresh and fine-grained resembling a devitrified glass where it is frozen against the top of the underlying flow. As the centre is approached the texture becomes coarser, until a coarse granitoid texture is reached. Just below the ropy fragmental top, the basalt, gabbro or diabase becomes quite amygdaloidal. In nearly every flow the amygdaloidal facies was observed below the fragmental surface.

The flows show little effects of dynamic metamorphism although they have been tilted into a nearly vertical position. In consequence they retain their massive character and are rarely altered to schists.

A thin section was made from a specimen taken from the centre of flow No. 4, which, under the microscope, revealed a remarkably fresh rock possessing ophitic or diabasic texture. The usual decomposition products such as chlorite were present. No primary quartz[1] was observed.

Description of Top of Flows

The surface of the flows is made up of angular, stony to sub-vitreous fragments of lava varying from a few inches to a fraction of an inch in width. Fragments of a peculiar, quite porous, bluish-black slag-like material, may be observed in the surface of these flows. This material is rarely angular in shape. Other fragments are of amygdaloidal basalt.

An analysis of the peculiar bluish black, slag-like material was made. It will be observed from the results tabulated below that chemically it corresponds with the average basalt:

	SiO_2	Al_2O_3	Fe_2O_3	FeO	CaO	MgO	K_2O	Na_2O	CO_2	H_2O	XyO
A.	48.64	14.81	6.02	9.78	7.28	4.56	4.10	1.72	0.88	2.18	....
B.	51.9	15.3	3.1	3.6	7.4	8.7	2.5	3.3	....	2.5	1.7
C.	48.76	15.89	6.04	4.56	8.15	5.98	2.93	3.43	....	1.88	2.61

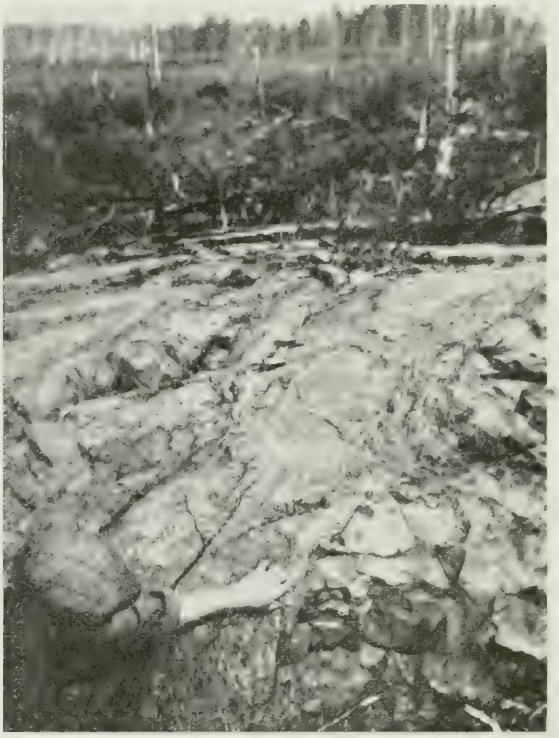
A.—Bluish black slag-like material from Cook township Lava Flows.
B.—Basalt—Pirsson; Rocks and Rock Minerals, page 225.
C.—Basalt—Reis & Watson; Engineering Geology, page 89.

[1] Ont. Bur. Mines Report, Vol. 28, Part II, p. 15, C. W. Knight.

The volcanic fragmental tops of the flows seem to have had a dual origin. Primarily they are autoclastic rocks formed by the inclusion of the partly solidified and broken-up crust of the magma in the still liquid magma below the crust, the whole then solidifying. Secondly, doubtless a goodly percentage of it is pyroclastic and has its origin in material thrown out during the effusion by the explosive action due to the release of vapors, principally water. No bedding was noticed in the various zones of this variety of fragmental materials.

An incipient pillow lava structure was almost invariably seen in the fragmental surface.

The contacts between the surface and the basaltic bottom of the succeeding flow were continuous and well defined.



View showing sharp dividing line between two lava flows in Cook township. The hand rests on fragmental top, and the finger points to exact line of contact.

The upper zones of all these flows bore the ear marks of effusive volcanic igneous rocks in that they had a marked development of the amygdaloidal, vesicular, scoriaceous, fragmental, spherulitic and ropy structures. Lithophysæ, whose origin according to Pirrson[1] is ascribed to repeated shells of crystallization and a subsequent expansion of the cavities through the influence of the aqueous vapor liberated at high temperatures, were also noted in several instances.

Chalcedony-like inclusions occurred in several of the clastic tops. These appear to be epigenetic, i.e., formed subsequent to the solidification of the rock. The mineral shows concentric structure and frequently forms a geode. This chalcedony-like material was probably formed in a similar manner to the precious opal which fills seams and cavities in certain igneous rocks, more particularly, trachytes. The

[1] Pirrson—Rock and Rock Minerals, p. 265.

opal, it is thought, was formed by the action of hot magmatic waters upon the silicates, the silica liberated, being deposited in the hydrous form.

Pillow Lava

The pillow lava structure was well developed in nearly all the flows. Generally it forms near the top of the flow although in several places it was observed near, or at the bottom, as is the case in Flow No. 6.

A close observation for corroboratory evidence of the criterion that "the flattening of the ellipsoids of the pillow lavas on their under side due to gravity can also be used to ascertain not only the attitude of the volcanics, but the upper and lower side of the flows" referred to by M. E. Wilson[1], was made. In no one instance could this be verified. It was found that an approximately even division existed between the number of flattened and rounded pillows, and there were as many pillows with the upward surface flattened, as with the lower.

A peculiar structure was observed in the pillows of flows Nos. 6 and 13. Concentric layers of basalt are interbanded with layers of spherulites which weather white. A thin section from the spherulitic band was made and it appears under the microscope as an aggregate of round figures built up of fibres radiating from a common centre. These fibres appear to vary in composition slightly at uniform distances from the common centre giving the spherulites the appearance of having been built up of successive concentric shells. Individual spherulites under polarized light show a dark figure resembling a maltese cross. The figure remained constant when the section was rotated.

A thin section of spherulites from Corriegillis, Island of Arran, Scotland, which from the description given, the writer takes to be much the same, has been described as follows[2]. "Part of the fibrous radiating structure becomes altered to a pale green substance which under the revolution of a single nicol changes from lighter to darker hues of greens, and under fully polarized light gives greys and steel blues of the first order which point to chlorite."

From a microscopic examination the writer does not care to hazard giving the composition of these spherulites, but Dana[3] states that spherulites in the volcanic rocks of Obsidian Cliff, Yellowstone Park, are believed to consist essentially of orthoclase needles with quartz.

Spherulites are indicative of sudden cooling and rapid crystallization and their presence may give additional evidence of the now generally accepted subaqueous origin of pillow lavas.[4]

Volcanic Tuff

The greenish colored, banded, rock which formed a bed on the surface of flow No. 8 is taken to be a silicified tuff. Examined under the microscope in a thin section its fragmental nature is easily discernible. The tuff is comprised of angular pieces, principally feldspar and quartz with fragments of other minerals or rocks. The rock weathers white. Other bands of this volcanic tuff were observed but in no one instance were they over two feet wide. In one case the tuff was observed to lie between the pillow lava and the ropy fragmental top. The tuffs appear to be made up of thin laminæ which on weathered surfaces show bedding and cross bedding lines. In connection with the presence of this silicified tuff in flow No. 8 it is interesting to note that this flow has a grey lava composition to a depth of 150 feet below the fragmental surface. It is therefore thought that the formation of the tuff in this instance was due to the high silica content of the grey lava, for lavas

[1] Memoir No. 39, Geological Survey of Canada, pp. 51 and 58.
[2] 20th century Atlas Microscopical Petrography, Part 5, p. 33.
[3] Dana, Textbook of Mineralogy, p. 372.
[4] Geikie, Ancient Volcanoes of Great Britain, p. 184. Daly, American Geology, Vol. 32, p. 78, 1902. Wilson, Canadian Geological Survey, Mem. 39, p. 54.

of this type are very viscous at temperatures which would render basic magmas relatively fluid[1]. The vapors, principally water, which have been contained in the magma under pressure prior to extrusion, escape with explosive violence while in basic magmas they pass off with facility. Consequently in the case of magmas of acid composition we might expect as is the case in this instance the formation of fine fragmental material.

Porphyritic Lavas

The porphyritic lavas, probably andesite porphyrites, referred to in the various flows, have been termed "leopard rock" on account of their spotted appearance. The white weathering phenocrysts or "globs" are sometimes one inch in diameter and show up in marked contrast against the darker colored, fine grained, ground mass. Some of the "globs" show evidence of crystal form but for the most part they are irregular in outline and may possibly, in part, represent a differentiation product rather than true phenocrysts. Under the microscope they show much fracturing due to dynamic metamorphism, and evidently were originally a plagioclase feldspar but are now so altered that only faint suggestion of the original polysynthetic twinning is revealed by the microscope. Concentration of the phenocrysts or "globs" is, as might be expected, greater near the centre of the porphyritic belt and lessens as the border is approached, decreasing in concentration until only sparsely scattered throughout the flanking basalt which shows, in some cases, an amygdaloidal structure. This fact identifies the porphyritic rock as part of the flow rather than an intrusive dike paralleling the strike of the flows.

A rock analysis of a sample taken from the porphyritic belt was made and the results are given below together with two other analyses for comparison. The high percentage composition of Al_2O_3 and CaO would point to the feldspar being the plagioclase variety, anorthite.

	SiO_2	Al_2O_3	Fe_2O_3	FeO	CaO	MgO	K_2O	Na_2O	H_2O	CO_2	XyO	Total
A.	40.30	28.94	4.70	1.53	16.2	1.23	0.92	2.71	2.99	0.64	....	100.16
B.	45.78	30.39	1.33	1.22	16.66	2.14	0.10	1.66	0.51	....	.....	99.79
C.	46.24	29.85	1.30	2.12	16.24	2.41	0.18	1.98	....	....	1.03	101.35

A.—"Leopard rock" from the porphyritic belt, Cook township Lava Flows.
B.—Anorthosite, Monhegan island, Maine, U.S.A., U.S.G.S. Bull 695, page 457.
C.—Anorthosite, mouth of Seine river, Rainy Lake, Ont.—Reis & Watson, Engineering Geology, page 80.

Alteration

The principal alteration products are epidote and chlorite. The alteration of the lime, iron and alumina silicates to epidote has in places been quite general: sometimes so extensively as to form masses which consist almost entirely of this mineral.

No mineral of the zeolite group was identified although a keen lookout was kept for these minerals which so frequently occur as secondary minerals in lavas, particularly basaltic ones lining cavities and coating jointing planes or composing the filling of the amygdules. Minerals of the zeolite group are quite common in the lava flows on Keweenaw Point, Michigan, U.S.A.

[1] Engineering Geology, Ries and Watson, p. 92.

Timiskaming Series?

East of Nettie lake, in Morrissette township, is a small area of clastic rocks and schistose derivatives. The writer has tentatively classed these rocks with the Timiskaming series owing to their similarity to certain rocks of the Kirkland area classified as Timiskaming, and the fact that they are intruded by a granite porphyry of the Algoman series. On the Martin claim, No. 8501, about 30 chains east of Nettie lake, is an outcrop of one of the upper horizons of these sediments which is a hard conglomerate comprised of water worn pebbles of greenstone, banded chert, an occasional granite and fragments of a bright red jasper, all of which readily separate from the matrix. The photograph, page 61, shows a specimen taken from this locality. The outcrop is poorly exposed and the structural relationship could not be ascertained. The lower horizons which outcrop on the east shore of Nettie lake and extend inland for 20 to 30 chains, are so impregnated with carbonates and schisted to such a degree that scarcely anything save the original clastic nature is discernible. Red jasper pebbles were seen in this rusty carbonate schist. At a point about 30 chains north along the east shore a faint suggestion of bedding was observed. The strike of the schistosity is N. 40° E., which is similar to that of like series noted in other areas[1]. A bright green talcose like mineral is abundant in the conglomerate of the upper horizon. This mineral was identified by W. K. McNeill, Provincial Assayer, as fuchsite.

Near the southern limit of Martin claim, No. 8501, a test pit has been sunk and considerable trenching done in the proximity of the contact of the granite porphyry and the rusty carbonate schist, classed as Timiskaming series. The border facies of the porphyry is a light green colored felsite mineralized with pyrite. Cracks in this felsite are filled with carbonate and are rusty. The mineral fuchsite was present in the felsite near the contact with the rusty carbonate schist.

A sample of the carbonated schisted clastic, similar to the rock comprising the outcrop at the water's edge along the eastern shore of Nettie lake, taken from an outcrop on Martin claim No. 8311, south east of Nettie lake, gave the following result on analysis:

Silica	56.20 per cent.	Magnesia	2.32 per cent.
Alumina	14.19 "	Potash	2.84 "
Ferrous oxide	2.27 "	Soda	2.33 "
Ferric odixe	1.54 "	Carbon dioxide	7.10 "
Sulphide of iron (pyrite)	4.05 "	Water (combined)	2.34 "
Lime	5.08 "		
		Total	100.26 per cent.

The Nettie lake fragmental rocks comprise the only occurrence of the Timiskaming series in the region.

Pre-Algoman Intrusives

In many localities the Keewatin series has been intruded by dikes and boss-like masses of diabase and lamprophyre dikes. The relationship of these to the Timiskaming series is unknown. Typical of these diabase intrusives is the one on the property of the Bourkes mine, forming the wall rock of the main ore body; and the diabase intrusion at the falls a few chains southeast of the office building. The diabase dike on the road allowance between the north half of lots eight and nine in the second concession, Benoit township, is also of this type.

Dikes of lamprophyre are common in the Keewatin. The dikes are usually quite narrow, the majority seen being under two feet in width. A schistose structure is frequently developed. A mica-lamprophyre dike 20 feet wide may be seen

[1] Geological Notes. Map No. 23a. (Kirkland Lake and Swastika Gold Areas), Ont. Bur. Mines, Vol. 23, Part II.

along the western boundary of Benoit township about 18 chains north of the southwest corner of the township. On the Mosher claim, No. 5834, Bernhardt township, a 12-inch mica-lamprophyre dike cuts the contorted schistose greenstone, striking N. 15° W. magnetic. This dike has been so impregnated with carbonate solution that it is altered largely to ankerite.

In several localities[1] contemporaneous with the lamprophyre dikes, are the complementary types. There is, for instance, a hornblende-lamprophyre dike 50 feet wide on the southern boundary of Melba township about one and three-quarter miles east of the southwest corner, and here an aplite dike striking north 2° west magnetic cuts in between the lamprophyre and the basalt. Other instances of complementary dikes will be cited later.

Algoman

The granite, syenite, grano-diorite (monzonite) batholiths and bosses, also the feldspar-porphyry and the quartz-porphyry dikes occurring throughout the area are thought to belong to the Algoman series. There is a possibility that minor occurrences mapped as Algoman on the accompanying map may be acid phases of the Nipissing diabase.

As has already been pointed out, the Timiskaming (?) series in the vicinity of Nettie lake was observed to have been intruded by a granite porphyry. This porphyry is typical of the area, variations being largely resultant from conditions of intrusion and solidification. Analysis of the granite-porphyry showed a silica content of 72.86 per cent. The eastern extension of the Winnie lake-Maisonville township batholith of hornblende-granite occupies the southwest quarter of Bernhardt township. This batholith varies quite locally from a hornblende-granite to a pink syenite or to a quartz-diorite. The two latter seem to be border facies of the granite, for this occurrence was particularly noted near the border of the batholith. The granite passes gradually into a syenite or grano-diorite without material change in texture, and this is indicative of some process of differentiation subsequent to the entry of a single body of the parent magma into its chamber rather than successive intrusions of different magmas. This feature was notably observed on the high ridge southwest of Bourzk lake. The pink syenite passes gradually to a granodiorite in which the hornblende predominates, and in which pink feldspar (orthoclase) and quartz comprise as low as 25 per cent. of the rock. A similar transition was seen northwest of Webash lake. The granite and syenite are always of a deep rose color.

The only other noticeable occurrences of granite are near Butler lake along the Benoit-Black boundary in the southwest corner of Black township, and in Thackeray township south of No. 3 post of claim No. T.T. 7. The first two occurrences have biotite and other femic minerals whereas that last noted is a binary granite.

In the monzonite, or grano-diorite, referred to on the accompanying map No. 30 c, the femic minerals predominate but quartz, pink orthoclase, and some plagioclase feldspar are plainly visible. Thin sections of this type of rock from three different localities under the microscope showed a wonderful development of a micropegmatitic texture, being an intergrowth of quartz and feldspar, one mineral containing particles of the other. The arrangements present a more or less regular pattern which, from its fancied resemblance to certain ancient inscriptions, has been also termed "graphic texture."

Many dikes of red and grey feldspar-porphyry cutting the Keewatin were seen. Under the microscope the rock shows phenocrysts of acid plagioclase, and occasional quartz and hornblende, imbedded in a fine grained groundmass consisting of feldspar, quartz and other minerals.

[1] See page 46.

A rather singular porphyry may be seen on James claim, No. 8201, in Morrissette township. The porphyry contains pink phenocrysts three quarters of an inch in diameter of orthoclase feldspar displaying a distinct zonal structure, and smaller (not greater than one quarter of an inch) phenocrysts of plagioclase feldspar with an occasional quartz, imbedded in a grey groundmass. The dike is 30 feet wide and strikes approximately northeast and southwest. The porphyry weathers a faint pink color. Many of the porphyry dikes seen in Bernhardt and Benoit townships have a general east and west strike. On Bergstrand claim, No. 6850, Benoit township, there are several dikes of feldspar-porphyry ranging in width from four to thirty feet, all of which have an east and west strike. These dikes closely resemble those in the southwest corner of Bernhardt township in that they have considerable hornblende and some larger blood-red feldspar phenocrysts.

The occurrence of quartz-porphyries is particularly confined to the Goodfish lake area and the vicinity of Jack Post camp, a few chains north of the third mile post on the southern boundary of Morrissette township. This porphyry has already been fully described by A. G. Burrows and P. E. Hopkins[1].

Cobalt Series

The Cobalt series represents the latest sediments of the area overlying the older complex. The series consist of conglomerate, greywacké, argillite, arkose and quartzite. Individual members of the series are not abruptly defined. In a general way there is an orderly succession from a basal conglomerate through slate-like greywacké and argillite to greywacké, or more rarely in this area to an impure quartzite or an arkose which in turn is overlain by an uupper conglomerate. The bedding planes, in all the outcrops seen, are horizontal or nearly so. The beds appear undisturbed.

The occurrence of the Cobalt series in the Black River area is confined to the townships of Black, Benoit and Lee.

In Benoit a hill 100 feet high in lot two in the first concession comprises the largest area. Small outcrops extend northward to the fifth concession; all outcrops are west of the lot ten and eleven line.

In Black township the distribution is more widespread, outcrops being seen in almost every section of the township. The 150-foot hill in this township west of Butler lake is a landmark for miles around. Here the lowest horizon is a conglomerate, largely composed of red granite boulders imbedded in a greywacké matrix. The uppermost horizon is a red greywacké, extremely resistant to weathering. The intermediate beds of argillite and slate-like greywacké being less resistant, have been more disintegrated forming a talus which spreads for several chains around the cliff's base on the north and west. The weathering of these intermediate beds leaves the upper ones overhanging, giving the hill a top-heavy appearance.

An outstanding feature of the larger outcrops is the precipitous faces. In Black township, for example, there are several east to west ridges and all have precipitous faces toward the north. Possibly these steep faces are due to faults.

As the individual members of this series have already been fully described [2], a repetition will not be made here.

The relationship of the Cobalt series to the underlying basement was only seen at a few points. In the southwest quarter of the south half of lot eleven in the second concession of Benoit township, a conglomerate underlying a bed of slate-like greywacké lies unconformably upon the eroded surface of Keewatin greenstone. The outcrop of conglomerate is only exposed by trenching for a few square yards.

[1] Ont. Bur. of Mines, Vol. 25, 1916, Part I., p. 260.
[2] W. G. Miller, Ont. Bur. of Mines, Vol. 19, Part II, 4th edition, 1913.
M. E. Wilson, Canadian Geological Survey, Mem. 39.

In Black township at a point two and a quarter miles north of Woollings' camp an east to west ridge of conglomerate has a sheer drop on the north side of 20 feet. About 100 feet north there is a low outcrop of basalt, mineralized with pyrite, which appears to directly underly unconformably, the conglomerate although the actual point of contact was obscured.

A glacial erratic of conglomerate 20 to 25 feet in diameter was observed just north of Woollings' camp and Scotties Springs road and about 20 chains east of the camp. Numerous other erratics are scattered throughout Black town hip.

Keweenawan Diabase

The youngest rocks of the pre-Cambrian in the Black River area are dikes and small intrusive masses of diabase, trap and gabbro. They may correspond in age to the Nipissing diabase, or the later olivine diabase dikes. They vary in texture from aphanitic to coarse in grain. A microscopic examination of them shows that they are augite-diabase irrespective of the texture. They show a texture which is identical with that of other well known Keweenawan rocks of Northern Ontario, i.e., a beautiful ophitic texture, the lath-like crystals of basic plagioclase cutting into and penetrating the crystals of augite. The percentage composition (megascopically examined) of the femic minerals varies and from the one outcrop specimens differing greatly in appearance may be obtained. The color and texture are variable according to solidification conditions. Small dikes and marginal masses are black, elsewhere the general color is greyish green to dark green and the texture medium. In some only a very minor amount of pyroxene is present. There are two types of diabase, one with olivine, the other olivine free the latter being by far the more common type.

The relationship with the older underlying rocks, other than the Keewatin, was seen only in a few instances. These will be cited later.

As much of the diabase mapped has been correlated only on petrographic evidence, it is possible that some may represent older intrusives. In this connection it is noted that P. E. Hopkins[1] states that in the area to the north there are diabases which microscopically are identical with the Nipissing diabase at Cobalt, but which appear older than the latter.

In both Bisley and Black townships, narrow complementry dikes were seen cutting the diabase. About 3 miles north of Woollings' camp, in Black township, there is an outcrop several chains in diameter of this fresh diabase. At the southern limit of the outcrop the diabase can be seen to intrude and overlie the Cobalt series. The visible member of the Cobalt series was an argillite. Complementary dikes occurred also at this point.

On the Bergstrand claim, No. 6850, being the southeast quarter of lot eleven in the fourth concession of Benoit township, one of the feldspar-porphyry dikes, already referred to in connection with the Algoman series, is paralleled on the south by a dike two feet wide of fresh diabase. The texture of the diabase is aphanitic at the contact, gradually becoming coarser until a fairly coarse texture is assumed. The diabase does not actually cut the Algoman porphyry: the gradation of texture, however, would point to the porphyry having been in place prior to the intrusion of the diabase. A similar relationship was also noted in the north half of lot eleven in the third concession of Benoit township.

In no one instance were the exomorphic effects of the diabase important. The intruded rock was apparently unaltered three or four inches from the contact.

[1] Marginal geological notes, Map No. 24a, Beatty-Munro Gold Area.

Glacial and Recent

It is roughly considered that at least 75 per cent. of the Black River area is overlaid with a mantel of boulders, gravel, sand and boulder clay. The clay, sand and gravel is frequently stratified or rudely so.

Much of the clay area of Benoit township is already settled and doubtless in time other level tracts of clayey soil throughout the area will be cleared for agricultural purposes.

No attempt was made to differentiate the areas of clay, sand or gravel, and a geological history of the glacial period does not fall within the scope of this work.

Economic Geology

The Black River area comprises 325 square miles of the great pre-Cambrian region, which in Ontario has produced such important mining centres as Porcupine, Kirkland Lake, Cobalt and Sudbury.

There is but one property in the area upon which a mining plant has been installed, and few localities where anything more than the most superficial prospecting has been done. Therefore, the fact that the area has not a producing mine, has little or no bearing on its future possibilities; but the fact that the formations are akin to those of neighbouring camps already proven, combined with the fact that there exists a widespread distribution of Algoman granite, syenite and porphyry intrusives, with which the deposition of gold is said to be associated, augurs well for the future of the area.

In proximity to these acid intrusives gold should be carefully prospected for, particularly where the greenstones have been rendered schistose. In these localities, as has already been pointed out[1], prospectors should be on the look-out for tin.

Veins are comparatively plentiful in the area and in some localities they appear well mineralized. The principal types being:—

(1) Fissure veins containing chiefly calcite, and minor quantities of quartz as gangue, with sphalerite, galena and other sulphides in subordinate amounts. These deposits are rarely auriferous in economic amounts.

(2) Quartz veins occupying fissures. These frequently contain pyrite, in crystals, and are often auriferous.

(3) Torsion cracks, which have been subsequently filled by solutions depositing quartz, comprise another class. These usually take the form of short lenticular splashes of quartz which, unless very numerous, could not constitute an ore body even though mineralized.

(4) Joint planes which have been filled with quartz. This type is almost invariably narrow and frequently carries free gold. The horizontal veins, occurring in the vicinity of Bourkes, have been classed with this type.

(5) Sheer zones have been infiltrated with quartz and calcite. The quartz and calcite lenses vary from a fraction of an inch to several inches, or a foot in width. The rock infiltrated by the quartz and calcite bearing solutions is usually impregnated with iron pyrites. The main vein of the Bourkes Mines Limited, is considered as one of this class.

(6) Pyrrhotite and sulphide bodies occupying channels similar to the foregoing. The sulphide bodies are believed to have the same origin as the auriferous quartz deposits, that is to say, to be genetically connected with the Algoman intrusives[2]. Granite or porphyry intrusions were observed in close proximity to these deposits, and in the deposit on the Post claim—No. LL. 4868, Morrissette township

[1] Cyril W. Knight, Marginal geological notes, Ben Nevis Gold Area, Map No. 29c.
[2] Miller and Knight, Metallogenetic Epochs in the Pre-Cambrian of Ontario, Trans. Royal Society, 1915, Vol. 9.

—the deposit on the footwall had a felsitic border facies 5 feet wide. The sulphide ores in northern Manitoba are believed to have had a similar origin.[1]

(7) Parallel slip planes coated with quartz and a thin film of molybdenite[2] as in the Goodfish Lake area.

Veins of the fissures and sheer zone types frequently contain brecciations of the wall rock, the edges of which have either been altered to secondary minerals or partially replaced by sulphides. Secondary minerals such as chlorite and epidote are common.

No general strike is common to the veins in the area; there is, however, more fissuring in an east and west direction, and at right angles thereto, than in any other. The channels, through which the vein-forming solutions passed, appear to have had a dual origin. From the close association of some of the gold-bearing veins (1) with the pre-Algoman diabases it is inferred that some of the fracturing,

Notably:—

1.—Main vein on Bourkes Mines Ltd. property.
2.—Auriferous veins on Webb claims, lot 7, con. I and II, Benoit township.
3.—Auriferous veins on Skjonsbye claim, lot 2, con. I, Benoit.

directly or indirectly, was caused by these intrusives. Again, numerous veins cut or parallel the Algoman intrusives and the fracturing forming this class may be attributed to these intrusives, which would mean that these deposits were formed immediately following the acid intrusions. The close connection between the gold quartz veins and the Algoman intrusives is shown by the occurrence of blotches or stringers, in practically all the veins, of a deep pink, feldspathic mineral, identified mainly as orthoclase feldspar. This is considered to be a seepage from the granite intrusives. Some of the narrow granite-porphyry dikes are reported to carry small gold values.

Gold occurs chiefly in the native state in narrow veins in a quartz-calcite gangue. Tellurides of gold are reported in several localities and have been identified[3] in the main vein on the Bourkes Mines Limited property. This latter occurrence—as the telluride—while unique has not to date proved to be of economic importance in Ontario. Gold is frequently associated with the minerals molybdenite and pyrite.

The cessation of work by the Bourkes Mines, Limited, has been a great setback to the further development of prospects in the vicinity of Bourkes; and while gold has been found on many properties, capital is lacking to prove or disprove their economic value.

To sum up, the greater part of the area has been but slightly prospected. Gold has already been found in many localities and the economic importance of these discoveries is still problematical. The vicinity of acid intrusions should be carefully prospected for gold and tin. The latter mineral may occur in quartz veins on the borders of granite knobs and in granite, or as grains disseminated through the rock adjacent to the granite. Quartz, topaz, tourmaline and fluorite are commonly found with tin deposits, as are also wolframite and scheelite, and other contact minerals.

The galena-sphalerite deposits should be carefully examined for silver and gold, which if present in sufficient amounts, would make these deposits workable. These deposits do not, however, appear to carry more than traces of gold, whereas silver values up to 57 ounces per ton have been obtained.

Description of Black River Area according to Townships

A more detailed account of the topography and economic possibilities of the nine townships of the Black River area is given in the following paragraphs, together with brief notes on some of the mining claims.

[1] E. L. Bruce, Mem. 105, Can. Geol. Sur. 1908, p. 61.
[2] Ont. Bur. Mines, Vol. 25, Part 1, 1916, p. 262.
[3] Ont. Bur. Mines Report, Vol. 26, p. 250.

Cook

Cook township consists largely of low country covered with an exceptionally fine growth of black spruce. Considerable wood for both pulp and lumber purposes has already been cut and timbering operations are still active. Practically none of the township is under cultivation. Only one settler's clearing was seen.

There are three important hills all comprised of Keewatin rocks, two along the boundary in the southwest corner, and one named Lava Flow mountain in the northwest part of the township.

The predominant rocks are Keewatin which in many localities are well exposed. The rocks are generally massive, and little fissuring was observed. Shear zones wherever seen had an east and west strike. Few veins were seen, and no extensive mineralization noted.

The Pike river and the creek which flows along the north portion of the third concession are not at present navigable owing to numerous log jams.

Barnet

Barnet township is west of Thackeray, and, like its neighbour, is not easily accessible. The shortest route is by the western boundary of Melba from where the Black river flows a few chains west of the line. This route was followed by our party, but the line especially along the western boundary of Barnet is poorly cut out, extremely difficult to follow, and not practicable for packing. It is therefore recommended that from the southwest corner of the township some alternative route be chosen to enter the township. The majority of the lot and concession lines are well cut out and offer good travel routes, particularly the line between the third and fourth concessions, which has been used as a trail.

It has been estimated that 15 per cent. of the township is rock and a like amount muskeg. There are few outstanding hills or ridges, the principal one being in lots one in the third and fourth concessions, and at the south of Fitter lake. From the last named point a splendid view of the township may be had. The balance of the township is characterized by the evenness of its landscape and the numerous creeks.

Patches of spruce and poplar suitable for pulp wood purposes are frequently met with. In the north of the township areas of sandy country exist, many of which have been burnt over. There are areas of clayey soil, well drained and suitable for agricultural purposes.

The Pike river is a good stream 50 to 60 feet wide, four to six feet deep with high banks, and a fair current. This stream, were it not for the numerous log jams, would be quite navigable, so far as we could judge from various views obtained during our exploration work, and if so it should be cleared out in order to give freer access, not only to Barnet, but to the northern part of Cook township as well.

The dominant rocks, are the same monotonous types of Keewatin Lavas so characteristic of this and adjoining areas. In small areas there are dikes and boss-like masses of granite, grano-diorite and porphyry. In no instance had the vicinity of these intrusives been exploited.

Thackeray

Thackeray township is accessible by a trail which follows the eastern boundary of Melba township northward from the crossing of the Black river. This trail was well travelled when the first stakings were made in the township and is still in good condition.

The general character of the whole township is that of a gently undulating tract of land. The north and northwest parts are largely jackpine, sand plain country. The rock outcroppings are not prominent, being confined to the southwest quarter of the township.

The prevailing rocks belong to the Keewatin series and the only outstanding geological feature is the many intrusive dikes of feldspar porphyry, and granite; a few of these have been shown on the accompanying map. A very beautiful syenite-porphyry containing rectangular, elongated phenocrysts of feldspar sometimes three quarters of an inch long and only one sixteenth to one eighth of an inch wide was seen *in situ*, in several places. This porphyry was noticed only in Thackeray township. The mineralized veins seem to be closely associated with the acid intrusions of porphyry or granite. Assays of gold were obtained but the writer is informed these were not high. The prospecting in Thackeray township appears to have been of an extremely superficial type which accompanies a "rush," and in reality does more harm than good to an area. From the numerous small dikes of the Algoman series and the amount of mineralization seen in places it would seem that this area should be more carefully prospected.

Grab samples from a test pit along the trail running north of the Howey camp site, and from workings thought to be on Andrews claim [1] did not give any gold values.

No free gold was seen on any of the claims although finds have been reported in this locality.

Base of "Defiance Peak," Black township. Note the almost horizontal strata of the Cobalt series.

Black

Black township is accessible either by the Woollings' camp road from Scotties Springs, or by the water route from Bourkes already mentioned.

The topography consists mainly of rolling well drained country with unimportant hills. The north of the township is more rugged. From the prominent peak of the hill west of Butler lake a commanding view of the township

[1] The writing on the claim posts is no longer legible and the claim lines are so irregular and difficult to follow that the writer was not positive of the claim. The discovery consisted of a highly inclined quartz vein containing inclusions of the 5-20 inch felsite dike which formed the footwall and of the Keewatin diabase which comprised the hanging wall. The quartz, the felsite dike and the hanging wall rock were well mineralized with sulphides.

may be had. Large sand plain areas exist. The road from the eastern boundary to the creek crossing, south of Errett lake, passes through jack pine sand plain country. There are numerous prominent sand ridges in the northwest section of the township.

The entire township is well timbered and there are many excellent patches of black spruce and of poplar. T. S. Woollings and Co., of Englehart, hold a timber permit for Black and Lee townships. Pulp wood cutting operations were commenced in the spring of 1920. Camps have been constructed in various parts of the township and by the fall of 1920 several thousand cords of pulp wood awaited shipment over the company's railroad to which steel is being laid from mileage 181 on the Temiskaming and Northern Ontario railroad westward into Black township.

Defiance peak, Black township, comprised of slate-like greywaké and conglomerate.

Geologically the outstanding feature of the township is the numerous remnants of the Cobalt series. In Black township as in the balance of the area the dominant rock types are Keewatin. Considerable fissuring, schistosity and mineralization was noted, particularly in the northeast part of the township. In this section there are some old stakings upon which much trenching has been done and a few test pits sunk. About one half mile west of Defiance peak there are some old workings, 30 to 40 feet deep, judging from the dump, on a highly mineralized calcite vein containing numerous fragments of the basaltic wall rock. The vein shows a banded structure of calcite and some basic material now largely altered to chlorite, heavily

mineralized with sulphides. Sphalerite is the most abundant mineral—then iron pyrites, galena and chalcopyrite in decreasing amounts as named. A grab sample failed to show any gold values. In the vicinity much mineralization was seen and it was thought that this section merited more intensive prospecting. Small areas of Algoman granite are exposed in the northeast and southwest of the township.

The only work in progress during the summer of 1920 was on claims along the trail west of Malloch lake. Here some blasting has been done on a vein complex in the Keewatin dolerite consisting of numerous lenticular shaped veinlets of quartz, slightly mineralized with pyrites. A 12-foot test pit has been sunk on a mineralized chlorite schist sheer zone, the strike of the schistosity being south 50 degrees east magnetic and dip almost vertical. The joint planes and planes of schistosity have been infiltrated with calcium carbonate. Values in gold are reported from this locality.

Benoit

The Temiskaming and Northern Ontario Railway runs through the centre of Benoit township, making all parts readily accessible; in addition road allowances have been cut and well used trails are numerous.

At present the only post office in the Black River area is situated at Bourkes, although it is understood that an application has been made for the organization

A settler's home and clearing along the Black river, in Benoit township.

of another in the north of the township on the railroad, about one half mile south of Scotties Springs, where a thriving settlement has recently been established. Black River is the proposed name of the new post office.[1]

Many quarter sections have been taken up as homesteads, much of the land is cleared and some is under cultivation. During the summer of 1920 there was an influx of settlers into the northern half of the township, especially along the Black river and the railroad.

The topography of the township is generally flat and the land well drained. Swampy areas are not large. The northwest quarter of the township is lagely sandy with occasional rock outcrops. A splendid growth of poplar and spruce suitable for pulp wood is scattered throughout the township and many cords have already been cut by the enterprising settlers.

[1] During the summer of 1921, Scotties Springs P.O., was opened at Yorkston station on the T. & N. O. railway in Cook township just north of the Benoit boundary.

There are few outcrops of rock and these are neither of great extent nor elevation, but rise, as low rocky knolls of greenstone and diabase, above the comparatively level clay-covered land. The rocks of the township are nearly all basic lavas of Keewatin age, the only variations being the small areas of granite, diabase and sediments of the Cobalt series. Feldspar-porphyry dikes are numerous.

Camp buildings of Bourkes Mines, Ltd., Benoit township, looking northeast from shaft.

Head frame and boiler house, Bourkes Mines, Ltd.

Gold has been found on several properties, and in practically every instance the values were obtained from quartz veins in the greenstone. Much of the greenstone in Benoit is quite schistose.

*Bourkes Mines, Limited**.—This property comprises the south half of lot nine in the second concession of Benoit. The rock outcrops are confined to a bend in the White Clay river: the geology is shown on the accompanying rough plan of the com-

(*) Reference has already been made to this prospect by A. G. Burrows. *See* Gold Bearing Veins in Benoit Township, Ont. Bur. Mines Report, Vol. 26, 1917, pp. 248-251. The asterisk (*) where it occurs again refers to the 1917 Report.

Plan of Bourkes Mines, Limited, scale 250 feet to the inch.

pany's premises. The White Clay river crosses the lot. Barometric readings of the water level showed a drop of 20 feet across the property. This drop is made up of rapids and small cascade falls of from one to four feet at various points along the river, chiefly in the portion of the stream flowing east.

The company have a plant installed which is apparently in first class condition and exceptionally well housed. The camps are well built and attractively located on the rising ground north of the White Clay river away from the workings.

The surface equipment, in the main, consists of a cookhouse, a bunkhouse, a mine superintendent's residence, a mine office, an equipped assay office, an equipped blacksmith shop, a boiler house with 2-100 H.P. horizontal F.T. boilers, hoist and compressor house with a 12-drill Allis-Chalmers-Bullock compressor and Ingersoll-Rand hoist with cylinders 10 inches by 12 inches. The equipment was installed and buildings completed shortly before the mine closed down.

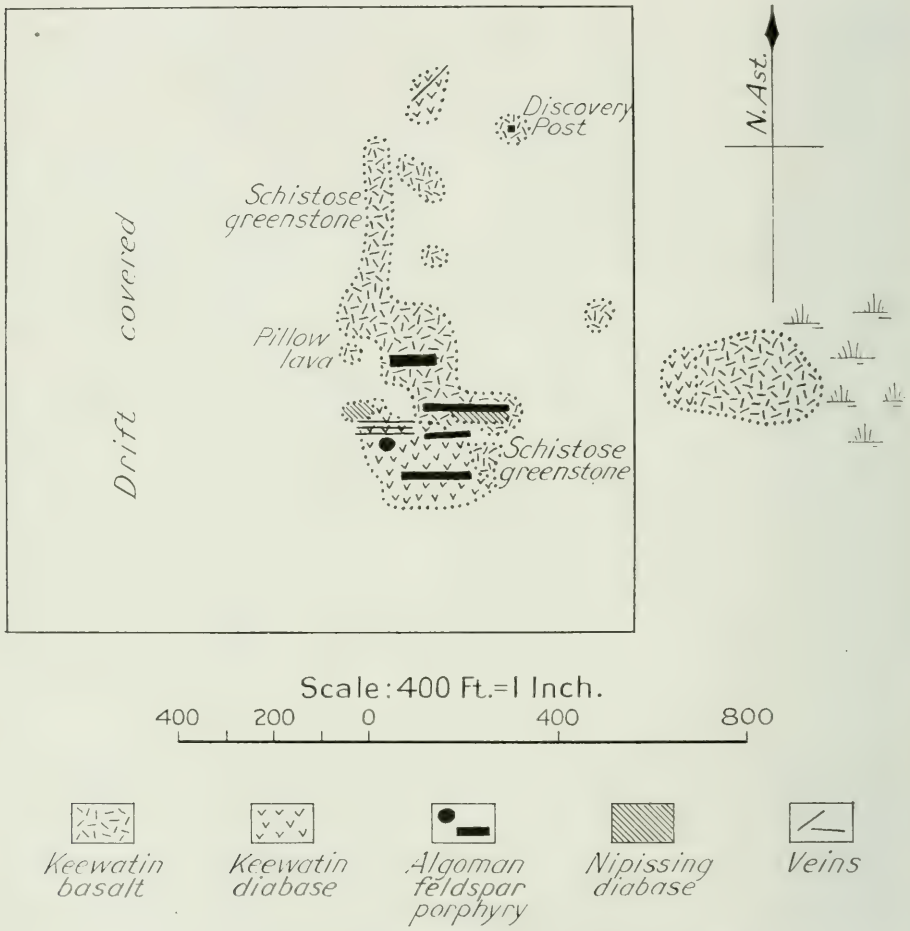
The shaft has been sunk on the main vein, which will be described later, to a depth of 400 feet and some drifting has been done at various levels. The underground workings were filled with water during the summer of 1920 thus preventing an examination of the developed ore body. Many specimens containing free gold are scattered about the dump and some of these are extremely rich in the precious metal. The gold was noted to occur in the quartz associated with calcite, the latter may have been a precipitating agent for the gold. A telluride of gold has also been identified.

The ore body consists of a shear zone striking south 28 degrees east magnetic, dip almost vertical. The rock in this zone is altered to a green contorted schist over a width of from four to eight feet. At the southern limit of the exposure a test pit has been sunk, and here the southwest wall consists of fairly fresh diabase and the northeast of basalt. At the northern limit these conditions are reversed. Into this shear zone have come the mineral bearing solutions filling the cavities and forming veins of quartz and calcite from a fraction of an inch to several inches in width. The gangue and contorted rock have been copiously impregnated with crystals of iron pyrites and lesser amounts of chalcopyrite, galena and molybdenite. Stringers of a deep pink feldspathic mineral, as well as narrow felsitic dikes, have also intruded this contorted rock. In places the wall is well marked while in others it appears to merge into the adjoining rocks.

Bunting Claims (*Johnson*) *Nos. 6639-6640.*—These claims comprise the west half of lot nine in the first concession of Benoit. On claim No. 6640 most work has been done. The greenstones, with some pillow lava structure and volcanic fragmental rocks, are cut by dolerite (diabase?) dikes. In close proximity to these intrusions are some well defined mineralized veins. Test pits have been sunk and stripping done on several of these. Near the southern boundary of this claim a shallow test pit has been sunk close to a vein junction, on a parallel quartz-vein system in a schistose zone. To a depth of three to four feet the schistose greenstone has been altered to a rusty carbonate. There is much mineralization with sulphides principally iron pyrites. The foregoing vein strikes north approximately, and immediately south of the test pit it is intersected by a quartz vein striking northeast. This latter is bordered by a narrow felsite dike.

Potter (*Wickstead-Maloof*) **No. 5381.*—An inclined shaft following the dip vein has been sunk to a depth of 40 feet. Along the footwall between the quartz vein and the pillow lava is a felsite dike heavily mineralized with sulphides. The vein outcrop is rusty and the greatest mineralization is along the footwall adjoining the felsite dike. Native gold was seen in places. The vein also contained specks of galena and some chalcopyrite. A channel sample taken across the vein and footwall dike from a point 12 feet below the surface, the shaft being full of water to this level did not give an encouraging assay for gold.

Scotvold Claims, Nos. 6184-5835.—Claim 6184 comprises the southwest quarter of the north half of lot five in the first concession of Benoit. The country rock is principally pillow lava. Some work has been done on a lamprophyre dike striking north, bordered on the west by diabase and on the east by pillow lava. The dike is mineralized with pyrite and Mr. Scotvold reports an assay of $3.00 per ton in gold. The dike continued north into Nelson claim No. 5831, and gold values are reported from the dike on this claim also.

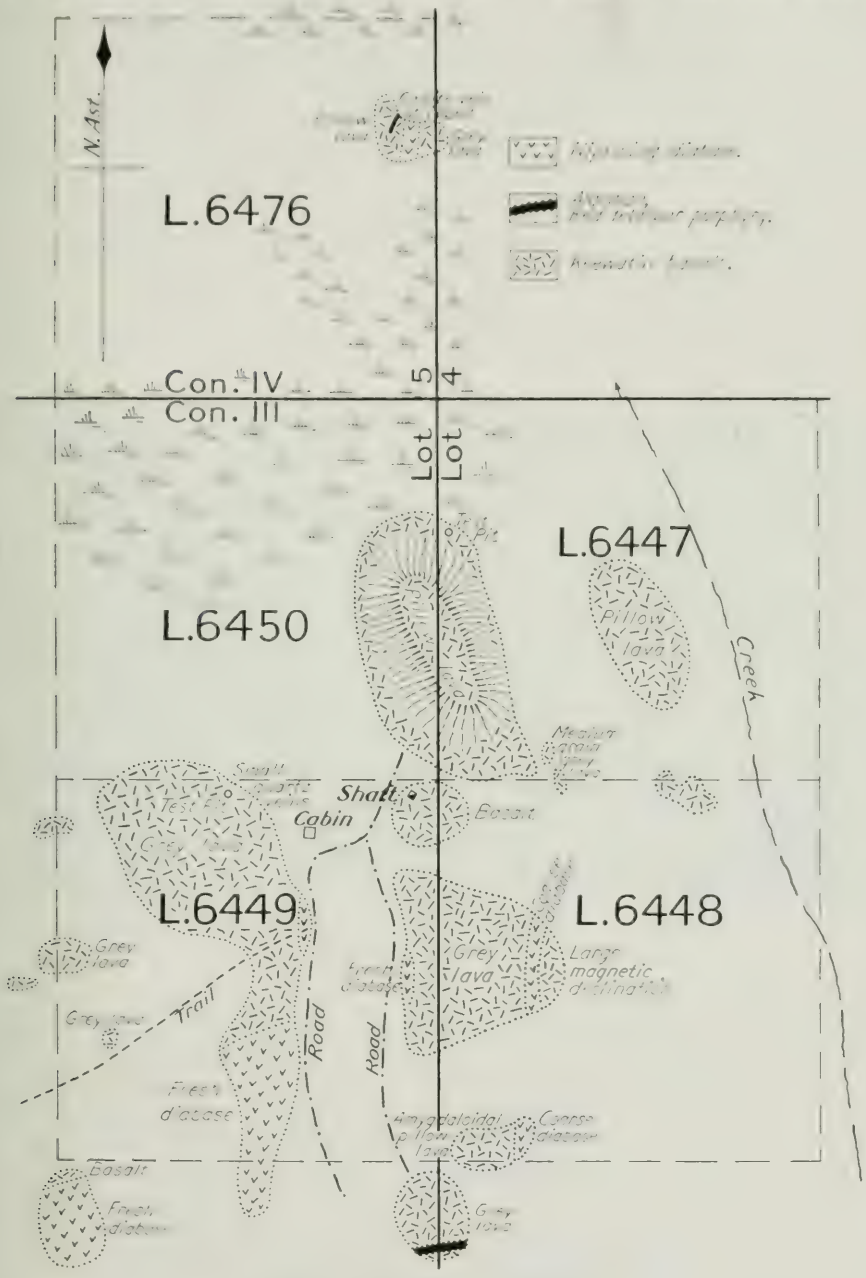


Geological plan of Bergstrand claim, Benoit township.

Bergstrand Claim No. 6850.—This claim is located in the southeast quarter of the south half of lot eleven in the fourth concession of Benoit. A plan of the claim is given on account of the interesting geologic features. Small assays of gold have been obtained from the porphyry dikes and some of the veins. Much surface work has been done and it is the intention of the owner to sink test pits on some of the more promising finds.

Cotterill Claims Nos. 5309, 5921.—The claims comprise the north half of the south half of lot seven in the first concession of Benoit. Considerable surface work has been done and various leads have been stripped and trenched. On claim No. 5921, near the southeast corner, are two parallel veins striking north 87° east and dipping 45 degrees south. The veins are 30 feet apart. The wall rock is somewhat

schistose, volcanic fragmental altered to chlorite and impregnated with iron pyrites. The principal discovery is on No. 5309 and consists of a well defined quartz vein striking south 80 degrees west. The greatest width of the vein is 6 feet and offshoots extend into the flanking altered rock. In places the main vein splits into a parallel system of veins, each a few inches wide. A test pit has been sunk to a



Geological plan of Thompson-McLeod claims, Benoit township.

depth of 15 feet. Near the bottom of the test pit, the vein which is six feet wide on the surface, divides into a series of veins cutting an altered porphyry and a basic rock impregnated with iron pyrites. Various assays of from $3.00 to $24.00 per ton in gold are reported.

Thompson-McLeod.—This group of claims is located in the north half of lots four and five in the third concession of Benoit, and the southeast quarter of the south half of lot five in the fourth concession. A plan of these claims appears in the text. The principal workings consist of an inclined shaft following the dip of a 16 inch wide vein striking south 8 degrees east and dipping about 65 degrees east, cutting a grey lava knoll. On the surface about 15 feet distant is another vein 4 inches wide with parallel dip and strike. From the west side of the knoll an adit has been driven along the strike for 60 feet. The adit connects with the main shaft about 20 feet below the surface. As the shaft was filled with ice to the level of the adit examination at depth was not possible, but the vein is reported to be several feet wide at the bottom of the shaft. The wall rock is schisted for a few feet on either side of the vein. The quartz is of milky white color, and in places it is stained with iron oxide. The wall rock and border of the vein are mineralized with pyrite. Free gold is reported to have been found in several places along the vein.

Thompson-McLeod vein and adit, Benoit township.

Skjonsbye-Klanderland.*—These claims have already been fully reported upon, only new features therefore will receive mention. A very favourable gold assay of $21.60 per ton was obtained from a grab sample taken from the dump surrounding a 14-foot shaft which was sunk on a flat lying 8 inch quartz vein. The shaft is located near the west boundary of lot two in the first concession about 10 chains south of the northwest corner of the lot. The wall rock within a few inches of the vein is heavily mineralized with pyrite and chalcopyrite, and there is also some of the same minerals in the vein.

The large outcrop just south of No. 1 post of claim No. L. 4287 shows two highly inclined lava flows and portions of two others.[1] Leopard rock, porphyritic greenstone, forms belts in some of these flows. In other particulars also, they resemble the Cook township lava flows.

[1] These flows were not seen by the writer but were reported by his assistant.

Webb.—This group of six claims comprises the north half of the north half of lot seven in the first concession of Benoit and the south half of lot seven in the second concession. Extensive surface work has been done and several pits sunk. Gold has been found in flat lying veins just north of the road allowance. The basalt in this vicinity is liberally impregnated with iron pyrites in crystals; some cubes one quarter of an inch in diameter were seen. A red feldspar porphyry dike striking a little west of north crosses the road allowance. The dike is well mineralized. South of the road a shaft has been sunk on the frozen basalt-porphyry contact. In October, at the time our survey party were withdrawing from the field, exploratory work on these claims was resumed under the personal supervision of the owner, G. F. Webb, of Hamilton, Ont. The shaft referred to was dewatered, a tripod horse power hoisting apparatus installed, and sinking resumed.

Melba

All parts of Melba are easily accessible from the Black river, which flows from east to west through the centre of the township.

The rock outcrops are mainly Keewatin and comprise roughly about 15 per cent. of the area. Two occurrences of pillow lava are perhaps worth noting because of their unusual features, one south of Douglas lake where single pillows were observed having a 5-foot major axis, and 2.5-foot minor axis; the other is on the southern boundary west of Kellett lake where the pillows have a porphyritic texture, their major and minor axis being 7 and 4 feet respectively.

Parts of the township are wooded with spruce and poplar suitable for pulp wood. Much of the township is swampy, but in the west half there is a goodly area of high clayey land suitable for agricultural purposes. No sand plain or sand ridge areas were seen. The few prominent hills have already received mention in the opening chapter.

Bisley

The eastern half of the township is largely low, poorly drained, spruce covered country and sand plain or ridge areas. The prevailing rocks are Keewatin and few intrusions were noted. There is one area of fresh diabase a little north of the centre of the township and in the neighbourhood of this some veins and dikes were seen. Prominent hills are confined largely to the vicinity of Lauramay lake, where several rocky hills over 100 feet high, are situated.

Bisley township appears to have been little prospected or travelled although it is accessible from the Black river.

The abnormal magnetic declination, as great as 70 degrees west on the section south from Lauramay lake to the southern township boundary, is worthy of note and investigation.

Bernhardt

The township of Bernhardt is one of the most rugged in the area, possessing many prominent ridges and hills. The height of land between the Hudson Bay and St. Lawrence drainage basins follows a general line from east to west across the centre of the township.

All parts of the township are readily accessible by canoe route from Amikougami lake. Thanks to the efficient work of the fireranger stationed in this township during the summer of 1920, practically all the trails and portages were brushed out and reblazed, making travel less difficult.

A feature of the geology of Bernhardt township is the large area in the southwest occupied by the granite batholith. Only the approximate boundary of this granitic intrusion was ascertained by sections. The balance of the outcrops in the township are basaltic in type; the only exceptions being the occasional small outcrops of fresh (Nipissing?) diabase along the northern boundary and west of Lancaster

lake and an occasional feldspar-porphyry dike. The southern part of the township has been the most prospected, resulting in gold discoveries on several claims. The township as a whole, however, does not appear to have been extensively prospected.

During the summer a few prospectors were engaged on assessment work on their claims and whenever possible these were examined. A few brief descriptions will be given here.

Ayoub Claim, L6075.—This prospect is located on the west shore of the northwest arm of Amikougami lake. The country rock consists of amygdaloidal basalt and pillow lava. At the lake side considerable stripping and blasting away of rock has been done on a quartz vein having some free gold showings. The vein continues into Bourzk claim No. 8242, to the north.

Bourzk Claim, 6354.—This claim is situated at the north end of the northwest arm of Amikougami lake. Considerable trenching, stripping and some blasting has been done on a vein complex in the pillow lava, 20 feet wide striking about north astronomic. The complex consists of a banded light grey to green felsite interbanded with quartz and calcite. In places the calcite bands are 15 inches wide. Minute stringers of a red feldspathic-looking material were also observed. Brecciations of the wallrock and of the felsite were included in the calcite. There was a scant mineralization with pyrite. Mr. Bourzk reports an assay of $5.40 in gold per ton from this vein.

Solomon Claim, 6429.—The claim is located on the west side of the northwest arm of Amikougami lake. A 15-foot test pit has been sunk on a 6 to 10-inch quartz vein striking approximately north astronomic. The vein cuts the basalt which has a schistose zone 8 feet wide with 1 to 3 inch quartz stringers paralleling the main vein. Assays, one from the surface of $18.00 in gold per ton and another from a sample taken across the 8 foot zone at the bottom of the pit of $4.80 in gold per ton, are reported. The vein has been stripped at intervals across the claim.

Mosher Claim No. 5834.—The Mosher claim is located about 20 chains east of Lancaster lake. Considerable surface work has been done and a test pit sunk on a vein junction located on the northeast of the claim. One vein, 5 inches wide strikes south 45 deg. east magnetic and dips 70 deg. to the southwest. It is located in a shear zone 5 feet wide. The foot-wall of this vein is volcanic fragmental and the hanging-wall is basalt. A channel sample across 18 inches including this vein gave no values in gold or silver. The other is a calcite and quartz vein striking north 15 deg. east magnetic and dipping 70 deg. west. Native silver in fine specks is disseminated in this vein. The owner reports an assay of silver, 37.5 ounces, and gold $2.20 per ton.

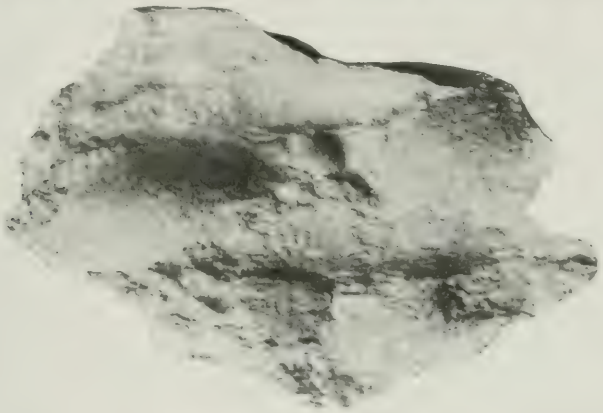
Challenger Gold Mining Company, Limited.—This group comprises seven unpatented claims situated northwest of Blue mountain. The property is best reached by trail from Bourkes. During the summer of 1920 a small party of men was engaged in clearing, building a camp, and in surface work. Some blasting and 300 feet of stripping has been done on a quartz-calcite vein varying from several inches to a few feet wide, striking south 40 deg. west magnetic. The vein, containing masses of the country rock, follows a contact between pillow lava on the northwest and a diabase dike (pre-Algoman?) on the southeast. There is some mineralization with copper and iron pyrites. A sample taken and forwarded by G. R. Webster—the company's president—to the Provincial Assay Office, Toronto, gave $8.40 in gold per ton. The value of the deposit is not yet determined.

Morrissette

Morrissette township is largely made up of low rolling country with some fine spruce swamps. With the exception of the swamp flanking the Black river and some minor areas, the township did not present many difficulties to travel as was expected from descriptions given to our party. A large sand plain and ridge area exists in the vicinity of the string of spring water lakes north of Nettie lake. A

splendid bird's eye view of Morrissette may be had from a prominent hill about the centre of the township. The Black river was paddled and surveyed southward from the north boundary for a couple of miles, and was found to be navigable even in the low water experienced in 1920. A rough trail, the old Lightning river trail, goes northeast from Jack Post camp, north of the three mile post on the southern boundary, to Columbus lake. The trail running from the northeast of Nettie Lake is also supposed to go to Columbus lake, but this trail could only be followed to the creek junction shewn on the map. It was surveyed to this point.

Geologically the area about Nettie lake is extremely interesting although to date no discoveries of economic importance have been reported. Along the east shore of Nettie lake is a continuous outcrop of a rusty weathering carbonate schist which is highly metamorphosed clastic rock. The clastic origin is still readily discernible megascopically. From the lake the ground gradually rises to the east, and inland 20 chains or so are numerous outcrops of conglomerate which very closely resemble the Timiskaming conglomerate in adjacent areas. From the relationship of the rusty schist to the conglomerate and from the fact that the strike of the schistosity is the same as that recorded for the Timiskaming series in the Kirkland Lake area this rock was classified as Timiskaming series. The Keewatin and the clastic rocks are both cut by granite-porphyry dikes at many points.



Conglomerate at Nettie lake.

An outcrop of fragmental rock is situated along the trail leading from the cabin at the south end of Nettie lake to the workings on the Martin claim. The outcrop consists of an 80-foot hill of pseudo-conglomerate. The matrix is a basaltic rock having a prevailing green color. The pebble and boulder contents consist not only of greenstone and amygdaloidal grey lava, but also pink weathering granite, porphyries and occasionally, red jasper. Some of the pebble and boulder contents are rounded. These may be best seen on the precipitous face on the west side of the hill.

There are numerous dikes of red and grey feldspar-porphyry, granite-porphyry and quartz-porphyry cutting the older formations. The intrusive dikes are confined to the Goodfish Lake, Nettie Lake and Jack Post camp vicinities.

The rocks of Morrissette township are mostly massive and schistose basalts and grey lavas. A high percentage of these are amygdaloidal, and considerable of the basalt has been altered to a rusty weathering carbonate.

Since the claims of the Goodfish lake area have already been amply described by Messrs. Burrows and Hopkins[1] further description will not be given here.

[1] Ont. Bur. Mines Report, Vol. 25, Part 1, 1916, pp. 260-263.

Archambault (Baissonault) Claim No. L 2632.—This claim is in the vicinity of Goodfish lake, its position being shown on the geological map accompanying this report. A line was cut in the direction of the strike from the gold-bearing zone along the contact of the quartz-porphyry and the basalt, on the Martin claim No. L 2232, to the above claim. A test pit was sunk on what promises to be a continuation of the Martin-Brennan vein. The test pit is on a carbonate zone along the contact between the greenstone and the quartz-porphyry. There is considerable mineralization of molybdenite and other sulphides, and promising assays in gold are reported.

Martin Claim No. L2232.—This claim, near Goodfish lake, has already been described, but at the time of the visit of Messrs. Hopkins and Burrows the shaft was filled with water. Specimens from this claim were seen by the writer showing free gold. The greatest concentration of gold values appears to be along the foot wall, where lamellar native gold occurs with molybdenite.

McKeen Claim No. L5399.—This property is also situated near Goodfish lake. Some trenching and blasting has been done on a belt of quartz-feldspar porphyry intruding a volcanic fragmental country rock which has been greatly altered to a rusty weathering carbonate. Nothing is known of the values obtained. The porphyry and the occurrence generally are similar to other properties in the area.

Martin Claims No. 8311 and No. 8501, Nettie Lake.—These claims are about 15 chains east of Nettie lake. During the summer of 1920 surface work was done on the above claims. As yet no important discovery has been made. A granite porphyry, in places altered to a rusty weathering carbonate, intrudes the clastic rocks, but the basalt-porphyry contact had not as yet (September 1920) been exposed by trenching. The schistose, metamorphosed clastic rocks and the border facies of the porphyry were well mineralized with pyrite in places.

Post Claim No. LL 4868.—Several test pits and a shaft have been sunk on this property which is located along the southern boundary of Morrissette township. The country rock is basalt and this has been intruded by a quartz-porphyry dike striking east and west approximately. The basalt near the contact has been highly altered to a rusty weathering carbonate. Several well-defined veins have been stripped. The shaft, which judging from the dump is 50 to 60 feet deep, has been sunk on a vein near the contact with the quartz-porphyry. The vein is heavily mineralized with sulphides, sphalerite, galena, chalcopyrite and pyrite, some of the chalcopyrite has been altered to malachite and azurite. The gangue is quartz, calcite and barite. The vein gave assays of from 4 to 57 oz. of silver per ton and small quantities in gold. A deposit of sulphides 6 to 8 feet wide, principally pyrrhotite, is located about 600 feet a little west of north from No. two post of the claim. The strike of the mineral body is north 62 degrees east magnetic and the dip about vertical. On the south side the sulphide body is bordered with a 5-foot band of felsite. The wall on the north is much fractured and the fractures filled with ferruginous gouge. Apparently this deposit did not yield favourable assays of gold for only a small test pit was sunk and work discontinued.

Claims in the Vicinity of LL 4868.—In this vicinity a good deal of surface work has been performed. The rock exposures are mainly basalt and are not large. The basalt is often schistose and altered to a rusty weathering carbonate, especially in proximity to the porphyry intrusions. Intrusions of porphyry are numerous. The prevailing strike of the porphyry dikes is east and west. The majority of the veins strike northerly; some cut the the porphyry dikes. As no work was in progress at the time of our visit to this area it is impossible to state whether or not gold or silver values were obtained in sufficient quantities to indicate workable deposits.

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PROVINCE OF ONTARIO
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HON. H. MILLS, MINISTER OF MINES THOS. W. GIBSON, DEPUTY MINISTER

THIRTIETH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

VOL. XXX, PART VII, 1921

The Stratigraphy and Paleontology

OF

Toronto and Vicinity

PART II.—THE MOLLUSCOIDEA

By

W. A. Parks and W. S. Dyer

PRINTED BY ORDER OF THE LEGISLATIVE ASSEMBLY OF ONTARIO

TORONTO

Printed by Clarkson W. James, Printer to the King's Most Excellent Majesty

1922

Printed by
THE RYERSON PRESS.

THE STRATIGRAPHY AND PALEONTOLOGY

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TORONTO AND VICINITY

Part 2.—The Molluscoidea

By

W. A. Parks, Ph.D., and W. S. Dyer, B.A.

Introductory Note

Part I of this series appeared as Part VI of the 29th Annual Report of the Ontario Department of Mines: it was prepared by Miss Helen Stewart and dealt exclusively with the Pelecypoda.

The present part treats similarly of the Molluscoidea and it is intended as a scientific revision of the phylum as well as a handbook for the guidance of local collectors.

Future parts will deal with the remaining groups of organisms and with the general stratigraphy and correlation.

The present investigations have been undertaken with the view of establishing with greater accuracy the subdivisions and correlation of the Paleozoic rocks exposed in the vicinity of Toronto. Large collections have been made, more particularly from the following localities: the Don brickyard or quarry; various exposures on the Humber river between Weston and the lake; the old shale pit in Lambton village; exposures on the Mimico river; exposures on the Etobikoke river; and the quarry at the prison farm.

This series of articles deals in the first instance with the fossils without regard to their exact stratigraphic significance and leaves the more important matter of correlation for the last part. This method of treatment is not the most desirable but it has been forced on us by the conditions under which the investigations have been carried on.

The phylum Molluscoidea contains two classes, Bryozoa and Brachiopoda. Of the former, twenty-two species and three varieties have been found in the Toronto rocks; most of these species are already known to science; a few, however, are new or of doubtful affinities. The Brachiopod fauna is small, containing only fifteen species of which probably only two are new and one a new variety. In addition are a few species of uncertain identification.

The illustrations accompanying this article were prepared in part from photomicrographs by the junior author. The drawings were made by the senior author, Helen Coleman, and E. B. S. Logier.

As in the case of Part I the classes Bryozoa and Brachiopoda of Toronto and vicinity will be reviewed in detail without particular reference to the distribution of the different species.—W. A. P.

BRYOZOA

A description of the different species is given hereunder:

Order GYMNOLAEMATA
Sub-order CYCLOSTOMATA
Family CERAMOPORIDAE
Genus CHILOPORELLA, *Ulrich*

CHEILOPORELLA, *Ulrich*. Jour. Cincinnati Soc. Nat. Hist. 5, 1882, p. 157.

The original description of this genus is as follows:

Forming heavy crusts or rising upward into flabellate fronds. Tubes long, traversed by few straight diaphragms. Cell-apertures ovate. Interstitial cells numerous.

Nickles and Bassler define the genus in more modern terms as follows:

Zoarium forming parasitic sheets, from which rise flabellate fronds or compressed branches; zooecial tubes long, thin-walled, irregular in shape in immature region, near the surface walls much thickened, diaphragms rarely developed; apertures ovate, lunarium conspicuously elevated; mesopores numerous.

CHILOPORELLA FLABELLATA (*Ulrich*)

Plate I, Figures 1 and 2; Plate II, Figures 1 and 2; Plate V, Figure 12; Plate VI, Figure 11.

FISTULIPORA FLABELLATA, *Ulrich*. Jour. Cincinnati Soc. Nat. Hist. 2, 1879, p. 28, pl. 7 figs. 26, 26a, 26b.
CHILOPORELLA FLABELLATA, *Ulrich* Geol. Surv. Illinois. 8, 1890, p. 381, pl. 39, figs. 5, 5b
CHILOPORELLA NICHOLSONI, *Nickles and Bassler*. Bull. U.S. Geol. Surv., 173, 1900, p. 207
CHILOPORELLA FLABELLATA, *Cumings*. 32nd. Ann. Rep. Dep. Geol. Nat. Res. Indiana 1908, p. 802, pl. 11, figs. 1, 1a; pl. 12, figs. 1, 1b.

The following description is founded on Ulrich's original definition amended by observations on our specimens. The zoarium consists of irregular, fan-like bifoliate expansions. The thickness usually varies from two to four millimetres. The surface is undulating, being raised into broad and inconspicuous monticules with the zooecial apertures disposed in bent and rather irregular rows. The openings are irregularly round to slightly oval, and are separated by intervals varying from nothing to a space as great or greater, than the diameter of the tubes themselves. An average of three zooecial openings appear in the distance of one millimetre and the interzooecial spaces show the openings of numerous mesopores.

Vertical sections show wide, open tubes and broad interspaces with mesopores in the peripheral region while in the immature region there are no mesopores but, owing to the inclination of the young cells, cross sections of prostrate tubes. No distinct diaphragms were observed. The mesotheca seems to be composed of very irregular, discontinuous, fluctuating laminae.

Tangential sections show the irregular character of the zooecial tubes, their varying distance apart, the thick walls of the peripheral region, and the aggregation of mesopores into groups in certain parts of the zoarium. Deep tangential sections show the absence of mesopores and the irregularly angular form and unequal size of the zooecia. This is shown slightly in the upper, right hand corner of Plate I, Figure 1.

Chiloporella flabellata occurs in the quarry on the Don in association with *Peronopora vera*, the only other bifoliate bryozoan in our rocks: from this species it is easily distinguished by the greater thickness of the fronds and the coarser character of the surface.

Locality.—**Don brickyard, Toronto.**
No. 1080 H. R. Royal Ontario Museum of Paleontology.

Genus Spatiopora, *Ulrich*

Spatiopora, *Ulrich*. Jour. Cincinnati Soc. Nat. Hist., 5, 1882, p. 155.
Spatiopora, *Nickles and Bassler*. Bull. U.S. Geol. Surv., 173, 1900, p. 24.

The description of this genus given by Nickles and Bassler is as follows: **Zoarium forming thin crusts, usually on *Orthoceras;* zooecia very short, nearly direct; apertures irregular, with blunt spines at the angles, no lunarium developed; elevated, elongated maculæ usually a conspicuous feature.**

Our collections indicate only one species of *Spatiopora* which appears to be new although it is closely related to a described form.

Spatiopora varians, *sp. nov.*

Plate I, Figure 3; Plate V, Figure 10.

The zoaria of this species form thin expansions on the shells of *Orthoceras* and present surfaces which are singularly different in different parts of the encrustation. The apertures are polygonal to slightly crescentic, and seem to be indistinctly arranged in a quincuncial manner from certain centres in the more typical parts of the surface. Measured along the rows about four apertures appear in one millimetre. At varying intervals—three to five millimetres—are groups of larger cells which are scarcely elevated above the general surface. This typical arrangement of the apertures is scarcely to be observed in other parts of the zoarial surface as the zooecia seem to emerge at an angle, with thickened walls, thus giving a crescentic appearance to the apertures and a vermiform aspect to the surface. Under a strong magnifier the walls of the cells seem to be thin except at the angles, where they are greatly thickened and stand up as sharp points.

Tangential sections show irregularly polygonal cells with fairly thick walls throughout but greatly thickened in places. In the thickened portion there is evidence of small angular interspaces and denser nodes which may be acanthopores. In deeper parts of the section there is evidence that the tubes are prostrate in the immature region and that they very quickly turn outwards to the surface. The varying character of the surface is probably due to the cessation of growth, in parts, before the outward turn had been completely effected.

Satisfactory vertical sections cannot be prepared owing to the extreme thinness of the zoarium.

This form is very closely related to *Spatipora maculosa*, Ulrich, and to *S. aspera*, Ulrich. From the former species it may be distinguished by the generally smaller apertures, the less conspicuous clusters of larger cells, the varying character of the surface, and the quincuncial arrangement of the cells.

The resemblance to *S. aspera* is even more striking. In both species the general size of the cells, the distance apart and character of the clusters, and the points at the angles of the tubes are alike. For *S. aspera*, Ulrich does not mention the quincuncial arrangement of the apertures or the varying character of the surface. These seem to be the main points of difference, as our failure to detect acanthopores in the tangential section may be due entirely to the state of preservation of the specimen. It is quite possible that further investigation may establish the identity of the two species.

Locality.—4-foot level, old shale pit, Lambton.
No. 1081 H.R. Royal Ontario Museum of Paleontology.

Sub-order TREPOSTOMATA

Family MONTICULIPORIDAE

Genus ASPIDOPORA, *Ulrich*

ASPIDOPORA, *Ulrich*. Jour. Cincinnati Soc. Nat. Hist., 5, 1882, p. 155; Geol. Surv. Illinois, 8, 1890, p. 373; Geol. Minnesota, 3, 1893, p. 254.

Ulrich's original description of this genus is as follows:

Very thin free expansions with a concentrically and radially striated epitheca covering the lower side. Composed of (according to age) from one to many unequal convex spaces. Cells gradually increasing in size from the margin of each convex space to near the centre of the same. Interstitial cells numerous. Both kinds of tubes crossed by diaphragms. Spiniform tubuli present.

In the report of the Geological Survey of Minnesota (*op. cit.*) he modifies this description as follows:

Diaphragms horizontal and closely set in the mesopores, usually wanting in the zooecial tubes, but one or more cystiphragms occur in most of the latter. In previous publications on this genus I did not mention the presence of cystiphragms because these structures seem to be wanting in the type species. My present opinion is that the supposed diaphragms figured by me for *Aspidopora areolata* are really cystiphragms, in part incorrectly drawn.

All later species ascribed to *Aspidopora* are characterized in particular by the presence of cystiphragms and the absence of diaphragms in the zooecial tubes. This feature together with the characteristic manner of growth define the genus *Aspidopora* as at present accepted. It is unfortunate that no further description or figures of the type species, *Aspidopora arcolata*, have appeared. The original figures certainly do not suggest the absence of diaphragms or the presence of cystiphragms and despite Ulrich's emendation it seems very unlikely that he would have overlooked in the type species so striking a characteristic.

Our rocks contain several species of *Bryozoa* characterized by discoidal manner of growth. Of these, some are possibly *Amplexopora;* one is ascribed to *Prasopora;* one is thought to belong to *Aspidopora* as defined above; and another is placed under *Mesotrypa*.

ASPIDOPORA *cf.* AREOLATA, *Ulrich*

Plate I, Figure 8; Plate II, Figure 8; Plate VI, Figures 7 and 8.

ASPIDOPORA AREOLATA, *Ulrich*. Jour. Cincinnati, Soc. Nat. Hist., 6, 1883, p. 164, pl. 7, figs. 2, 2c.

MONTICULIPORA AREOLATA, *James*. *Ibid.*, 16, 1894, p. 183.

Ulrich describes the species as follows:

Zoarium consisting of very thin, convex, free expansions, from .3 to 1.0 of an inch in diameter, and about .025 of an inch in thickness. The under surface is marked with radiating striae, and sometimes with obscure concentric wrinkles. The upper or celluliferous surface presents a variable number of slightly convex and irregularly angular spaces with an average diameter of about .15 inch. At the margin of these convex spaces the cell-apertures are circular, and 1/110 of an inch in diameter. The cell-apertures gradually become broadly elliptical, and larger as the centre of the spaces are approached, where the largest have a diameter of 1/80 inch. The apertures of the cells are often closed by a centrally perforated, thin operculum. The interstitial spaces are occupied by elongated apertures of very shallow interstitial cells. The spiniform tubuli are quite numerous and prominent.

In longitudinal (vertical) sections the proper tubes are prostrate for half their lenigth, when they bend upwards and proceed directly to the surface. Their walls are thin and more or less flexuous, especially upon the concave side of the tube. The interstitial tubes are developed from the upper wall of the prostrate portion of the proper zooecia, and enlarge very rapidly, so as to attain their full size, at the second diaphragm. In the proper tubes the diaphragms are present only in the lower half of the tube where it is crossed by two or three. At their apertures a very thin calcareous line representing the opercula mentioned may sometimes be detected. In the interstitial tubes the diaphragms are crowded. The spiniform tubili are first developed near the cell-apertures, where if carefully looked for a variable number may be detected. A second layer of cells is often found above the first.

Tangential sections show that the cells have very thin walls, those of adjacent tubes being entirely separated, or in contact only at limited points. Their diameter becomes greater as the centre of the convex spaces or monticules is approached, while they at the same time vary their shape from sub-circular to oval or elliptical. The interstitial spaces are occupied by large, usually hour-glass-shaped interstitial cells, which are occasionally divided into halves by a very faint wall. Comparatively large spiniform tubuli are developed at all the points where the true cells come in contact.

A single specimen from the old shale pit at Lambton so closely conforms to the above description that we have little doubt as to its identification. It must be admitted, however, that the horizon is so far above that of the type that some doubt must be entertained, especially in view of the fact that we were unable to prepare a vertical section without sacrificing the whole of the specimen. The tangential section shows the characteristic appearance as described above. No distinct cystiphragms are to be seen near the surface, but where the section is deep and slightly inclined (right hand side of figures on Plates I and II) there is an indication of cystiphragms in the zooecial tubes and of numerous diaphragms in the mesopores which seem to be more prostrate than one would conclude from the original figures and description.

Locality.—Five-foot level, old shale pits, Lambton.
No. 1082 H.R. Royal Ontario Museum of Paleontology.

Genus Mesotrypa, *Ulrich*

Mesotrypa, *Ulrich*. Geol. Sur. Minnesota, vol. 3, pt. 1, 1892, p. 257.

Ulrich describes this genus as follows:—

Zoaria hemispheric, conical, or discoidal, generally free, with the lower surface covered by an epitheca. Zooecial tubes prismatic or cylindrical, more or less separated from each other by angular mesopores; internally with oblique and sometimes funnel-shaped diaphragms, that often simulate and probably are to be regarded as peculiarly, modified cystiphragms. Mesopores becoming smaller with age, intersected by numerous diaphragms. Acanthopores generally present, sometimes of large size.

Mesotrypa (*?*) *sp. nov.*

Of frequent occurrence on the Humber river is a discoidal bryozoan with a concentrically wrinkled epitheca which may attain a diameter of 25 mm. The surface is gently convex and practically smooth; the under side is correspondingly concave. The thickness varies, and superposition of layers is not uncommon; a single layer is generally about one millimetre thick.

The surface shows, in places, sub-quadrate zooecial openings more or less regularly arranged and occurring to the number of nine in the space of two millimetres: in these areas the walls seem to be in contact. In other parts of the surface the openings are larger, more rounded, and separated by distinct interspaces although the zooecia are never completely out of touch with each other.

Tangential sections show that the walls are moderately thick and independent even where the mesopores are absent and the zooecial walls in close contact. Very small acanthopores are sparingly developed. Vertical sections show the zooecial tubes to arise with a slight slant from the basal plate and to proceed almost directly to the surface with walls of practically the same thickness throughout. The zooecial tubes are crossed by numerous irregular diaphragms for about two-thirds of their length; the peripheral third seems to be devoid of internal structures. The diaphragms are slanting and irregular and occasionally simulate cystiphragms. Between the zooecial tubes are numerous mesopores, crossed by close-set, horizontal diaphragms, which continue to the surface. These mesopores show distinct evidence, in places, of narrowing towards the surface of the polyzoarium.

There is little doubt that we have to deal in this instance with discoidal bryozoans that have usually been ascribed to *Amplexopora discoidea*, Nicholson, probably because that author makes the following statement:

An outwardly similar form occurs in the Hudson River group of Canada; but not having prepared thin sections of this, I am not certain of its identity with the Cincinnati type. [1]

In the Report on the Paleontology of Ontario Nicholson states definitely that *Amplexopora discoidea* occurs at Weston but this publication antedates by several years "The Genus Monticulipora."

That the form under review can not be *Amplexopora discoidea* is proved by the numerous and irregular diaphragms in the zooecial tubes, and by the abundance of mesopores with well developed diaphragms; that it is not *Mesotrypa whiteavesii* is sufficiently indicated by the number and character of the diaphragms of the zooecial tubes and the relative size of the mesopores. The absence of true cystiphragms, the fact that the zooecial tubes are in contact at some points, and the smooth surface of the zoarium will serve to separate this form from *Prasopora donensis*. It is with this species however, that the closest affinities are shown. In vertical section the chief difference is in the total absence or rare occurrence of true cystiphragms in the present form. In tangential sections the difference is more pronounced as *Prasopora donensis* shows rounded zooecial tubes completely isolated by mesopores and crossed by the characteristic crescentic lines of cystiphragms.

The proper generic reference of this species seems to be peculiarly difficult. The distinctness of the tube-walls, with the dark lines of demarkation between, indicates as clearly as we have ever seen the division *Integrata* of Ulrich and Bassler. The numerous mesopores, however, make it impossible to ascribe the form to the family *Amplexoporidae* and the other families of the division are even more remote. The relation to *Prasopora* in the occasional occurrence of cystiphragms, the irregular character of the diaphragms, and the numerous mesopores in some instances tapering to nothing at the surface, strongly suggest *Mesotrypa* and there we provisionally place the species.

The specific characteristics seem to be new but as the description was delayed until after the plates were made we have been unable to include any figures. A specific name, therefore, is not proposed at the present time.

Locality.—Humber river, Toronto.

No. 1200 H. R. Royal Ontario Museum of Paleontology.

Genus PERONOPORA, *Nicholson*

PERONOPORA, *Nicholson*. Genus Monticulipora, 1881, pp. 102, 215.
PERONOPORA, *Ulrich*. Jour. Cincinnati Soc. Nat. Hist., 5, 1882, p. 153.
PERONOPORA, *Ulrich*. Geol. Surv. Illinois, 8, 1890, p. 370.

The presence of cystiphragms in the mature region is said to be characteristic of all members of the family *Monticuliporidae* but in the case of the genus *Aspidopora* there seems to be a degree of departure from this rule. *Peronopora* and *Prasopora*, the only other genera represented in our collections, show this feature to perfection. Both of these genera show cylindrical to polygonal zooecial tubes with both cystiphragms and diaphragms; they both have mesopores and acanthopores, the former with numerous diaphragms. In *Peronopora* the zoarium is always bifoliate whereas it never assumes this form in *Prasopora*. The cell walls are thicker in *Peronopora*. The genus is thus defined by Ulrich:

Zoaria bifoliate, the surface even, usually with small maculae. Mesopores and acanthopores varying in number. Cystiphragms abundant, present throughout the mature region in the zooecial tubes. Apertures circular or polygonal. Zooecial walls comparatively thick, sometimes ring-like in transverse section.

[1] The Genus Monticulipora, p. 195.

Peronopora vera, *Ulrich*

Plate I, Figures 4 and 5; Plate II, Figures 4 and 5; Plate V, Figure 3.

Peronopora vera, *Ulrich*. Amer. Geol., 2, 1888, p. 40.
Peronopora vera, *Nickles*. Bull. Kentucky Geol. Surv., 5, 1905, p. 46, pl. 2, fig. 1.
Peronopora vera, *Cumings*. 32nd. Ann. Rep. Dep. Geol. Nat. Res. Indiana, 1908, p. 867, pl. 22, figs. 2-2b; pl. 31, fig. 5.

Nickles' description is as follows:

Zoarium consisting of bilaminar fronds from 2 to 6 mm. thick and 10 or more cm. in height. Fronds usually somewhat undulating and occasionally producing fronds at right angles. Some specimens branch rather frequently, others rarely. Surface smooth, except for clusters of larger cells which sometimes rise a little above the general level. Apertures circular, seven or eight of the ordinary size in 2 mm. Apertures in the clusters considerably larger than the others. Usually a large amount of circular or subangular mesopores occupy the rather wide interspaces as well as the angles of junction. Often the centre of a cluster is occupied with a large number of mesopores. In some specimens few mesopores are present. Occasionally a specimen shows a large number of small acanthopores at the surface, these may also be seen in some sections. The zooecia have a very short immature region; in the mature region they have a linear series of overlapping cystiphragms and a few diaphragms.

This species is not uncommon in the quarry on the Don river and has often been mistaken for *Heterotrypa frondosa*. The figures of tangential sections (Plate I, Fig. 4; Plate II, Fig. 4) show the characteristic appearance of true tangential section on the left hand side; on the right hand side the section is deeper and slightly inclined showing both zooecial tubes and mesopores in inclined or longitudinal section. The vertical section, from a photomicrograph, is shown without retouching in Plate II, Figure 5; it is rather confused owing to the impossibility of cutting a section exactly parallel to the various elements. The drawing (Plate I, Figure 5) was made by combining the most typical parts shown by the same thin section. The median plane is marked by a very thin line on both sides of which appear the bases of the zooecial tubes and of the mesopores which seem to alternate with a considerable degree of regularity. The base of the zooecial tube is trapezoidal and small, that of the mesopore is hexagonal and larger. The mesopores are crossed by crowded diaphragms throughout; the zooecial tubes have diaphragms in the lower half and cystiphragms in the upper.

Locality.— Don Valley brickyard, Toronto.
No. 1083 H.R. Royal Ontario Museum of Paleontology.

Genus Prasopora, *Nicholson and Etheridge Jr.*

Prasopora, *Nicholson and Etheridge Jr.* Ann. Mag. Nat. Hist., 4th Ser., 20, 1877, p. 38.
Prasopora, *Ulrich*. Geol. Surv. Illinois, 8, 1890, p. 371.

This genus of the *Monticuliporidae* is defined by Ulrich (*op. cit.*) as follows: Zoaria forming hemispheric, discoid, or irregular masses, and, more rarely, thin expansions; usually free, with an epithecal covering on the lower side. Zooecial tubes prismatic or cylindrical, thin-walled, largely separated from each other by small angular mesopores, which are generally quite inconspicuous at the surface. Acanthopores usually present, but only occasionally either numerous or strong. Cystiphragms in all the zooecial tubes. Diaphragms crowded in the mesopores.

Prasopora donensis, *sp. nov.*

Plate I, Figures 6 and 7; Plate II, Figures 6 and 7; Plate V, Figure 6; Plate VI, Figure 2.

The zoarium of this species is circular and free, probably with a concentrically wrinkled epitheca. The diameter ranges from 17 to 20 mm. and the thickness is approximately one millimetre. The upper surface is gently convex and the under surface correspondingly concave. The celluliferous surface shows

that the ordinary apertures are arranged in quincuncial rows springing from a number of very ill-defined centres. They are usually hexagonal in outline and occur to the number of four in the space of one millimetre. At intervals of 2.5 to 3 mm. are clusters of larger cells, and at about the same interval occur slightly defined monticules. The clusters and the monticules are not necessarily coincident nor are they necessarily the centres of the quincuncial systems.

Tangential sections show that the ordinary zooecial tubes are nearly or quite circular but that they become elliptical as the centres of the clusters are approached. The walls of the zooecial tubes are comparatively thin and independent, touching each other in the direction of the rows but separated in other directions by a number of large angular mesopores. Cystiphragms appear in nearly every tube. Acanthopores are scarcely to be discerned but there is some evidence of very small ones at the points of junction of the tubes.

Vertical sections, where ideally cut, show about five well-developed cystiphragms and clearly defined diaphragms in the zooecia, the latter being confined to the lower part of the tube. The mesopores are crowded with diaphragms.

This species has decidedly the surface characteristics and manner of growth of the genus *Aspidopora* and approaches very closely to *Aspidopora newberri*. Nicholson. We would without hesitation, ascribe the species to *Aspidopora* were it not for the undoubted diaphragms in the zooecial tubes.

Except for the somewhat larger size, the species closely resembles *Prasopora lenticularis*, Ulrich. The vertical sections are almost identical, but the tangential section of *P. lenticularis* shows a closer spacing of the zooecial tubes and a less development of mesopores. The arrangement of the zooecial tubes in rows is apparently a feature of both species.

Locality.—Don brickyard, Toronto.

No. 1084 H.R. Royal Ontario Museum of Paleontology.

Family HETEROTRYPIDAE

Genus ATACTOPORA, *Ulrich*

ATACTOPORA, *Ulrich*. Jour. Cincinnati Soc. Nat. Hist., 5, 1882, p. 154. *Ibid.*, 6, 1883, p. 245.

Ulrich's amended description of this genus is as follows:

Zoaria parasitically attached to foreign bodies, over which they form thin and expanded crusts, the thickness of which varies according to the number (rarely more than three) of superimposed layers, the latter having an approximately definite thickness. Zooecia with more or less thick walls, and indented or floriform orifices, due to the position of the numerous spiniform tubuili, which in the thick-walled species are developed almost exclusively in the portion of the walls immediately surrounding the visceral cavity. True interstitial cells are wanting. At regular intervals the surface presents subsolid elevated "maculæ" that are granulose and finely pitted, and apparently composed of peculiarly modified or aborted cells. Diaphragms few, always horizontal.

Only one species of this genus has been recognised in the rocks at Toronto, *Atactopora maculata*, described below.

ATACTOPORA MACULATA, *Ulrich*

Plate I, Figure 10; Plate II, Figures 9 and 10; Plate V, Figure 1; Plate VI, Figure 10.

ATACTOPORA MACULATA, *Ulrich*. Jour. Cincinnati Soc. Nat. Hist., 2, 1879, p. 121, pl. 12, figs. 2-2c; *ibid.*, 6, 1883, p. 245, pl. 12, figs. 2, 2a.

Ulrich's original description, slightly modernized, is as follows:

Zoarium parasitic, growing into expanded crusts, which vary in thickness from less than .5 to 4 mm.; the usual thickness is about one millimetre. All the specimens observed are attached to species of *Orthoceras* or *Endoceras*. Surface exhibiting rounded or elongated tuberosities, which are abruptly elevated, and from .5 to 1 mm. in

diameter; sometimes they are arranged in quite regular diagonal lines, but usually are irregularly distributed over the surface; measuring from their centres, the distance that they are apart varies from two to nearly four millimetres; summits of maculae somewhat flattened and compact. Zooecial orifices sub-equal, moderately thin-walled, polygonal, about eight in the space of two millimetres; mesopores few or entirely absent. Superior edges of tube-walls, when well preserved, carrying a few small spines.

Transverse sections show very distinct projections into the zooecia. They number from four to five and are very irregularly distributed. In sections of this kind the maculae present the appearance of clusters of minute tubuli, which undoubtedly is their true nature. In vertical sections the zooecia are usually without diaphragms, though these structures are not infrequently developed in moderate numbers. The maculae appear minutely tubular, and are divided into distinct floors, that run parallel with the outline of the projection of the tuberosities on the surface. In a specimen two millimetres in thickness, there are about five of these floors.

This species is not uncommon in the Don brickyard. Our specimens conform fairly well with the description given. There are, however, three points in which they differ. In the first place our specimens do not seem to be attached to *Orthoceras* or *Endoceras*, but it is quite possible that they grew originally on the shells of the latter genus. Fairly flat pieces have been found which measure two or three inches in length and width. In the second place our vertical sections show a considerable number of downwardly-curved diaphragms in the zooecia; and in the third place we have not found any evidence of superimposed layers.

The photograph of the surface (Plate V, Figure 1) shows well the arrangement of the apertures: the points out of focus are the maculae. The tangential section shown in the photograph (Plate II, Figure 10) shows the dense maculae and the thick walls of the zooecial tubes; it fails, however, to indicate the petaloid character of the openings or the numerous acanthopores. These features are better shown by the drawing (Plate I, Figure 10). Satisfactory photographic reproduction of a vertical section was not obtained: the drawing (Plate II, Figure 9) is fairly typical, but in some places the zooecia are more open towards the surface and the diaphragms fewer.

Locality.—Don brickyard, Toronto.

No. 250 H.R. Royal Ontario Museum of Paleontology.

Genus Dekayella, *Ulrich*

Dekayella, *Ulrich*. Jour. Cincinnati Soc. Nat. Hist., 5, 1882, p.155; *ibid.*, 6, 1883, p. 90.
Dekayella, *Nickels and Bassler*. Bull., U. S. Geol. Surv., 173, 1900, p. 31.

Ulrich's description follows:

Ramose, branches often compressed. Mesopores more or less numerous, often aggregated into irregular maculae. Acanthopores of two kinds; large ones arranged as in *Dekayia*, and a much greater number of small ones. Diaphragms in both sets of tubes straight.

It will be observed that the essential point in distinguishing this genus from the related *Dekayia* and *Heterotrypa* is the presence of two kinds of acanthopores. Cumings maintains that this feature is not confined to *Dekayella* and would make the three genera identical.

Dekayella ulrichi (*Nicholson*)

Plate I, Figures 9 and 11; Plate V, Figure 9.

Chaetetes fletcheri, *Nicholson*. Quart. Jour. Geol. Soc. London, 30, 1874, p. 504, pl. 29, figs. 6, 6a; Pal. Ohio, 2, 1875, p. 197, pl. 21, figs. 7, 7a.
Monticulipora (Heterotrypa) ulrichi, *Nicholson*. Genus Monticulipora, 1881, p. 131, fig. 22.
Dekayella ulrichi, *Ulrich*. Jour. Cincinnati Soc. Nat. Hist., 6, 1883, pp. 91, 153.
Dekayia ulrichi, *Cumings*. 32nd Rep. Geol. Nat. Res. Indiana, 1908, p. 824, pl. 14, figs. 4, 4b; pl. 28, fig. 7.

Nicholson's original description with some few terms modernized follows:

Zoarium ramose, of cylindrical or sub-cylindrical branches, which divide dichotomously at irregular intervals, and vary in diameter from less than four to about eight millimetres. The surface is smooth and destitute of monticules, but in well-preserved specimens minutely spinous; the calices sub-polygonal or rounded, mostly .25 mm. or slightly more in diameter. Interspersed with the openings of the ordinary zooecia are the minutely irregular apertures of a largely developed series of small mesopores.

As regards internal structure, the corallites are at first thin-walled, but become thickened in the outer part of their course, their walls becoming at the same time seemingly fused together. The mesopores occupy all the intervals left between the oval or rounded larger tubes, and there is a largely developed series of thick-walled hollow acanthopores, placed at the angles of junction of the zooecia. Diaphragms are wanting, or are very sparingly developed in the axial region of the branches, but are abundantly present in the outer portion of the tubes, and are much more closely set in the mesopores than in the zooecia. In all cases, the diaphragms are complete and approximately horizontal.

Ulrich removed the species to his new genus *Dekayella* on account of the presence of two kinds of acanthopores, large and small. The former originate in the immature region while the latter appear only in the mature or superficial region.

This species has long been considered as one of the most typical fossils from the Don river; it has been identified by more than one author; and has been regarded as the chief evidence of the Eden age of these beds. While we are not prepared, in the face of many statements to the contrary, to deny the occurrence of this form, we fail to find among many dozens of thin sections any definite evidence of its occurrence. Nearly every specimen which has been ascribed in our collections to this species turns out on microscopic examination to be *Hallopora subplana*. As the surface is in every instance obscured by hard shale in the apertures, the identification has been made merely from the shape of the zoarium which is indistinguishable from that of *Hallopora subplana*.

While we are unable at present to include this species with certainty it is thought advisable to refer to it in view of what has been said above. Nicholson's original figures are reproduced herewith: it will be observed that the tangential section does not show the two kinds of acanthopores.

Genus Leptotrypa, *Ulrich*

Leptotrypa, *Ulrich*. Jour. Cincinnati Soc. Nat. Hist., 6, 1883, p. 158; Geol. Surv. Illinois 8, 1890, pp. 377. 455; Geol. Minnesota, 3, 1893, p. 316.
Leptotrypa, *Simpson*. 14th Ann. Rep. State Geol. Surv., N.Y. for 1894. 1897, p. 580.
Leptotrypa, *Nickles and Bassler*. U.S. National Museum, Bull., 92, 1915, p. 717. (*See* for fuller synonymy.)

Leptotrypa is an incrusting form of *Heterotrypidae* defined as follows:

Zoarium incrusting, often assuming cylindrical, discoidal, or other forms; zooecia tubes polygonal, with thin walls, and few or no diaphragms; acanthopores small, never abundant; no mesopores.

Leptotrypa expansa, *sp. nov.*

Plate I, Figure 12; Plate II, Figure 3.

Our collection contains one good specimen of an exceedingly fine-grained incrusting bryozoan covering the surface of a flattened fragment of *Orthoceras* 80 mm. by 30 mm. in extent. The surface shows polygonal apertures to the number of five or six in a millimetre. In well preserved parts delicate but distinct spines are to be observed at the angles of the zooecial openings. At intervals of two millimetres are small clusters of slightly larger cells raised into monticules. These elevations are arranged more or less in diagonal lines

Tangential sections indicate thin-walled zooecial tubes, strictly polygonal, and with coalesced walls where in contact with one another. Where not in contact the zooecial wall is rounded and only about one half the thickness of the coalesced walls (not well shown in the diagram). The interspaces, therefore, vary in size, are not very numerous, and are always bounded by convex sides. Acanthopores occur at the angles of junction of the zooecial walls but by no means at every such angle. Occasionally a small acanthopore is seen in the wall: it seems to belong to one proper wall and to project slightly into the zooecial space on that side. Satisfactory vertical sections were not secured, but inclined parts of the tangential section indicate that the tubes are inclined or prostrate in the immature region and without diaphragms. The varying size of the interspaces and their lack of true walls leads to the conclusion that they are not to be interpreted as mesopores.

This species is closely related to *Leptotrypa minima*, Ulrich, with which it agrees in the character of the surface, spacing of the monticules, and intimate structure of the zoarium for the most part. It differs, however, in that the monticules are not formed of smaller cells than the average but of larger. The zoarium is of greater size and is not always attached to a small species of *Orthoceras* "from .3 to .6 of an inch in diameter at the larger end."

Locality.—Four-foot level, old shale pits, Lambton.
No. 1085 H.R. Royal Ontario Museum of Paleontology.

Genus Stigmatella, *Ulrich and Bassler*

Stigmatella, *Ulrich and Bassler*. Smiths. Misc. Coll., 47, 1904. pp. 24, 33.

The description is as follows:

Zoarium incrusting, massive or sub-ramose; mesopores present, often restricted to small spots; acanthopores small, more or less abundantly developed at intervals between which they are wanting; in ramose forms they are developed in the extreme outer region.

The more extended description by the same authors is given below:

Zoarium variable, ranging from incrusting to irregularly massive and ramose. Zooecia angular, rounded, or irregularly petaloid, the shape depending upon the presence (or absence) of mesopores and the number of acanthopores. Typically the zoarial surface exhibits at regular intervals maculae or spots composed of mesopores, although in some species the usual monticules or clusters of large cells appear. Acanthopores always present but variable in number, intermittent, developed chiefly in narrow zones, sometimes inconspicuous but more often so numerous as to give the surface a decidedly hirsute appearance. Mesopores, when present, developed in mature region only, their number being variable even for the same species.

The zooecial tubes have thin walls in the axial region and these become but slightly thickened in the peripheral region where a few unusually delicate diaphragms are inserted. In vertical sections the walls exhibit at rather regular intervals in the peripheral region thickenings somewhat similar to those occurring in *Stenopora*. These thickenings occur approximately at the same height in the wall, and tangential sections through these zones give the full development of acanthopores. Minute structure of walls as shown in tangential sections, of the type that characterizes the *Heterotrypidae*.

Representatives of this genus are among the commonest fossils of the Toronto rocks, but, owing to the varying shape of the zoaria and the differing manner of growth, they are among the most difficult to recognize. Ramose, encrusting, irregular, "puff-ball," and many other types are of common occurrence. In nearly every instance sections are necessary in order to make even an approximate identification. We recognize eight more or less distinct types, but in all probability further detailed work would reveal more. Three of our forms agree fairly well with described species, and three others are thought to represent varieties of another species. Two new species have been created.

Stigmatella crenulata, *Ulrich and Bassler*

Plate III, Figures 4, 5 and 7; Plate IV, Figures 4 and 5.

Stigmatella crenulata, *Ulrich and Bassler*. Smiths. Misc. Coll., Quart., 47, 1904, p. 34 pl. 9, figs. 1-4; pl. 14, figs. 1, 2.
Stigmatella crenulata, *Cumings*. 32nd Ann. Rep. Dep. Geol. Nat. Res. Indiana, 1908, p. 882, pl. 24, figs. 4-4d.
Stigmatella crenulata, *Bassler*. U.S. Nat. Mus., Bull. 92, 1915, p. 1193.

The original description of this species follows:

Zoarium composed of cylindrical, subcylindrical or compressed, frequently dividing stems 10 mm. or more in diameter, arising from a broad base and forming a clump probably seldom more than 50 mm. high. Surface even, but in well-preserved mature specimens spinulose because of the many acanthopores. Maculae well marked, generally composed of mesopores which make up the characteristic "spots" but sometimes formed exclusively of zooecia larger than the ordinary. Zooecial apertures small, about 9 in two mm. with their walls thin and often beautifully inflected by the numerous small acanthopores. Mesopores present, variable in number but usually few and mostly aggregated in the maculae. In the axial region the zooecial tubes have thin finely crenulated walls and occasionally a diaphragm or two. In the mature region the walls increase slightly in thickness, mesopores and acanthopores develop, and thin diaphragms cross the zooecial tubes and mesopores at varying but always comparatively remote intervals.

This is a common species on the Humber river, Toronto. We are unable to add anything to the description given and every feature mentioned by the authors has been observed.

Plate III, Figure 5 was drawn from a photograph of a part showing a macula near the bottom; Plate IV, Figure 5 is a photographic reproduction of a section showing no maculae but with the mesopores more scattered. Plate III, Figure 7 is copied from Nickles and Bassler but in no way differs from our sections.

Locality.—Humber river, Toronto.

No. 1086 H.R. Royal Ontario Museum of Paleontology.

Stigmatella catenulata, *Cumings and Galloway*

Plate III, Figures 1, 1a, 2 and 3; Plate IV, Figures 1, 2, 3.

Stigmatella catenulata. *Cumings and Galloway*. 37th Ann. Rep. Dep Geol. Nat. Res., Indiana. 1913. p. 437, pl. 19, figs. 1-1c.

This species is described as follows:

Zoarium robust, subramose 1.5 to 2 cm. in diameter and 5 or 6 cm. long. Surface nearly smooth, with low round monticules or large maculae, composed of mesopores and large zooecia. Zooecia subcircular, with medium thin walls. Mesopores are usually restricted to the clusters, but sometimes, on immature branches, there may be a small area on which the mesopores are numerous.

Tangential sections show the zooecia to be subpolygonal and thin-walled, with a light coloured intermural line; 9 zooecia in 2 mm. Where there are mesopores the zooecia are smaller, but there is the same number in 2 mm. including mesopores. The acanthopores are small but conspicuous, about 1/40 mm. in diameter, about 10 in 10 zooecia. They are situated at the angles of junction of the zooecia and never inflect the zooecial wall. Mesopores are usually few or absent in sections near the surface, but occasionally a section will show a region of numerous mesopores, especially if the section is deep or taken from an immature branch.

Diaphragms are absent in the axial region and there are only one or two in the mature region. The zooecial walls are only slightly thickened in the mature region which is 2 or 3 mm. in depth. The chain-like mesopores are the noticeable feature of longitudinal sections. They begin in the submature region and ordinarily do not reach the surface. Where the diaphragms cross the mesopores there is a constriction giving to the mesopores the appearance of chains or strings of beads. The zooecia walls are nearly straight or only slightly flexuous.

Species of *Stigmatella* showing distinct chain-like mesopores are of frequent occurrence in the rocks at Toronto. The only species in which this character is pronounced are *S. interporosa*, Ulrich and Bassler, *S. sessilis*, Cumings and Galloway, and *S. catenulata*. All of our specimens are distinct from *S. interporosa* as the great development of mesopores characteristic of that species is not seen. One of them resembles *S. sessilis*, and three others approach so close to *S. catenulata* that they are included in that species although varietal differences are marked.

The first type which we may call variety (a) approaches most closely to typical *S. catenulata*. The zoarium is irregularly ramose, with flattened branches which appear to be hollow. An average branch is about 15 mm. by 8 mm. The surface is marked by very small and inconspicuous monticules, 2 to 3 mm. apart.

Tangential sections show groups of larger, thin-walled, polygonal zooecia to the number of nine in a space of two millimetres, and areas with considerably smaller and more rounded zooecia with frequent mesopores. As many as twelve zooecia were counted in the space of two millimetres. Sections very near the surface present almost exactly the appearance of Cumings and Galloway's figures except that the acanthopores are not rigidly confined to the angles of the zooecia. Sections at moderate depth show scattered large acanthopores; many of them not at the angles of junction, and often strongly inflecting the zooecial cavity (Plate III, Figure 1). Sections cut at a still deeper level are almost devoid of acanthopores.

Vertical sections show that the tube-walls increase very little in thickness towards the surface and that the characteristic chain-like mesopores are well developed. Diaphragms in the zooecial tubes are of rare occurrence.

This variety differs from the type only in the character of the acanthopores and in the more rugose surface.

A second variety (b) which it seems impossible to remove from this species has grown around a small crinoid stem to a length of 80 mm. and a total thickness of 25 mm. The surface is nearly smooth but has, nevertheless, low inconspicuous elevations at wider intervals than in the last variety.

Tangential sections show the large and small zooecial tubes, as in variety (a), with a slightly greater tendency to rounded form in the small zooecia. The acanthopores are small and practically confined to the angles of the zooecia; in fact, the section is not to be distinguished from that of the type.

Vertical sections likewise are very like those of the type. The mesopores are rather coarser than in variety (a) and there are more diaphragms. These structures, however, are of such tenuity, that they may have broken down in variety (a).

This variety differs from the type chiefly in the manner of growth as it is distinctly incrusting on a crinoid stem and shows no indication of ramose habit.

Variety (a)

Locality.—Five-foot level, Lambton shale pits.

No. 1097 H.R. Royal Ontario Museum of Paleontology.

Variety (b)

Locality.—Seven-foot level, Lambton shale pits.

No. 1088 H.R. Royal Ontario Museum of Paleontology.

A third form ascribed to this species, variety (c), is so distinctive that it should, perhaps, be described as a new species. The prominent chain-like mesopores and the slight dissimilarity in vertical section, induce us to retain it under *S. catenulata* but with a definite varietal name as below.

STIGMATELLA CATENULATA DIVERSA, *var nov.*

Plate III, Figures 8, 8a.

The main portion of the zoarium of this variety is a roughly spindle-shaped mass about 40 mm. long and 20 mm. wide at the middle. From this central mass a few branches seem to have been given off but as they are broken away nothing can be said as to their length. The surface is covered with large rounded monticules at intervals of about five millimetres. The apertures of the zooecia between the monticules are fine and regular but on the summits a great diversity in size is to be observed.

Vertical sections are scarcely to be distinguished from those of the two varieties described above except for the presence of more numerous diaphragms. With regard to the chain-like mesopores a critical examination shows the following features in the three varieties:—

Variety (*a*) Mesopores, numerous, large, well developed in the mature region.

Variety (*b*) Mesopores, smaller, less numerous, and scarcely developed in the mature region.

Variey (*c*) (STIGMATELLA CATENULATA DIVERSA). Mesopores few, except in restricted areas, not well developed in the mature region; zooecial walls crenulated and passing into the chain-like mesopores in the immature region.

Tangential sections (Plate III, Figures 8 and 8a) are very distinctive. The general field shows regular, polygonal, thin-walled zooecia to an average number of ten or eleven in the space of two millimetres. In this region mesopores are very few and small. Acanthopores are well developed, usually, but not always, at the angles of junction of the zooecial walls and sometimes slightly inflecting the tubes. At intervals of about five millimetres the structure is distinctly different (Figure 8) as the zooecial tubes are large and rounded, the mesopores numerous and of very irregular shape, and acanthopores practically absent.

Externally this variety can easily be recognized by the large rounded monticules; in tangential section the structure as described above is unique; in vertical section, it is difficut to separate from the other varieties, particularly that described as variety (b).

Locality.—Humber river, Weston, Ontario.

No. 1089 H.R. Royal Ontario Museum of Paleontology.

STIGMATELLA LAMBTONENSIS, *sp. nov.*

Plate II, Figure 13.

This species is founded on a single specimen from the old shale pit at Lambton. The zoarium is ramose with flattened branches arising from a common clump; an average branch is about 12 mm. by 7 mm. The general aspect of the branching zoarium is less robust than in the specimens which we have ascribed to *Stigmatella crenulata* but otherwise it is very similar.

The surface is smooth and apparently without maculae but it is of insufficient extent and too poorly preserved to justify the statement that maculae are absent.

Vertical sections (Plate II, Fig. 13) show about five zooecial tubes to the millimetre and well illustrate the periodical thickening of the walls characteristic of the genus. Diaphragms are fairly numerous and very irregular showing curvature, and, in some cases, a high inclination to the zooecial walls. Mesopores are infrequent, chain-like, and sharply defined. They have very thick walls and extend, in some cases, into the mature region. The lower part of the figure is not cut

parallel to the direction of the tubes: other sections show that the walls are thin in the immature region and with few diaphragms.

Tangential sections are very like those of *Stigmatella crenulata* showing polygonal zooecial tubes, scattered angular mesopores and an occasional spot of aggregated mesopores. Acanthopores are large and abundant and are nearly always situated at the angles of the zooecial tubes. Near the surface where the zooecial walls are thick the acanthopores do not inflect the tube-walls, but deeper down, where the walls are thin, a distinct inflection is observed.

In many respects this species resembles *Stigmatella crenulata*, but the crenulated walls of that species are never seen. In vertical section it is almost identical with *Stigmatella sessilis*, Cumings and Galloway.[1] At first we were inclined to regard the present species as identical with *S. sessilis* but the very different manner of growth seems to make its separation necessary.

Locality.—Five-foot level, old shale pit, Lambton, Ontario.
No. 1090, H.R. Royal Ontario Museum of Paleontology.

Stigmatella vulgaris, *sp. nov.*

Plate I, Figures 13 and 14; Plate VI, Figure 12.

In the Don Valley brickyard one of the commonest fossils is the "puff-ball". This seems to be a variable species of *Stigmatella* of which the zoarium is of considerable size, massive, nodose, subhemispherical, or even thick discoidal in shape. The appearance of the specimen which is selected as a type is indicated in Plate VI, Figure 12. This specimen measures 80 mm. by 55 mm. by 30 mm. Other examples, of a roughly hemispherical shape, frequently measure 50 mm. in width and 20 or 25 mm. in height. While it is quite possible that more than one variety or even species is represented by the various specimens, we have not been able to recognize constant features by means of which they can be differentiated.

The surface of the type is smooth, and maculae are indicated only by clusters of larger cells very indistinctly developed at intervals. Tangential sections very near the surface (Plate I, Fig. 13) show zooecia of very irregular shape and size with thick walls and numerous large acanthopores. We are inclined to regard the smaller cells as young zooecia rather than as mesopores. In places, the cells are somewhat larger but no other difference is observed. Deep tangential sections are strikingly different: the same irregular character of the tubes is seen, but the walls are extremely thin and the acanthopores less numerous and very small (Plate I, Fig. 14).

Vertical sections show very thin-walled zooecia crossed by a few distinct diaphragms chiefly in the peripheral zone. No structures which can be interpreted as distinct mesopores are seen. In places the walls are crenulated and in others quite straight. The structure is intermediate between that of *Stigmatella crenulata* and *S. personata*. It may be regarded as intermediate between figures 4 and 6 of Plate III.

The hemispherical examples of this species show no difference in vertical sections, but tangential sections are almost devoid of acanthopores, and groups of larger cells are more distinctly developed; in some cases very large zooecia appear among the smaller ones. In one case the surface is distinctly monticulose but the sections do not differ in any distinct manner.

Locality.—Don brickyard, Toronto.
No. 1091 H.R. Royal Ontario Museum of Paleontology.

[1] Dept. Geol. Nat. Res. Indiana, 37th. Rep. 1913. p. 439. pl. 19, fig. 3; pl. 20, fig. 2-2b.

Stigmatella *cf.* personata, *Ulrich and Bassler*

Plate III, Figure 6; Plate IV, Figures 6 and 7.

Stigmatella personata, *Ulrich and Bassler*. Smiths. Misc. Coll., Quart. 47, 1904, p. 36, pl. 12, figs. 1-3.

Stigmatella personata, *Cumings*. 32nd Ann. Rep. Dept. Geol. Nat. Res. Indiana, 1908, p. 884, pl. 24, figs. 3, 3d.

The original description of this species is as follows:

This is one of the non-mesopored species of the genus and forms smooth branching zoaria very much like *S. crenulata* and *S. spinosa*. From the former it is distinguished by having fewer acanthopores, and in lacking the crenulation of the walls in the immature region. From *S. spinosa* it is separated by its larger zooecia, 7 to 8 being found in 2 mm. while 10 are required in that species to cover an equal distance.. The acanthopores in *S. Personata* also afford a difference, being but seldom more numerous than the junction angles which they usually occupy. In *S. spinosa*, it will be remembered, they are so abundant that they almost completely surround the zooecium.

Ulrich and Bassler record this species as uncommon in the Richmond formation at Hanover, Ohio. Cumings recognizes it in a single specimen from the top of the Richmond series on Elkhorn creek, near Richmond, Indiana.

Associated with *Stigmatella crenulata* on the Humber river are a number of coarsely ramose forms, externally very like that species. The branches arise from a clump-like base and are frequently twenty millimetres in greater diameter. The surface is almost smooth but generally shows irregular, very low, rounded monticules, which we have used to differentiate the two species externally. Tangential sections (Plate IV, Fig. 7) show angular zooecia of variable size, in some places as few as 7 in 2 mm. but generally more numerous. Small acanthopores occur at the angles of junction of the zooecia in certain parts of the sections, in others they are practically absent.

Vertical sections show the straight, uncrenulated zooecial walls characteristic of the species, but in the immature region there is sometimes a slight degree of crenulation. Diaphragms are very few in most cases and are more common in the mature region.

The lower horizon of these forms makes us somewhat doubtful in ascribing them to *S. personata* but they certainly approach closer to that species than to any other described form. *S. personata*, *S. crenulata* and the form we have described as *S. vulgaris* seem to be much alike. They differ in the manner of growth, the slight variation in the smaller tubes (mesopores ?) and more particularly in the degree of crenulation of the zooecial walls.

Locality.—Old shale pits, Lambton; Humber river, Lambton.
Nos. 1092, 1093 H.R. Royal Ontario Museum of Paleontology.

Stigmatella *cf.* clavis (*Ulrich*)

Leptotrypa clavis, *Ulrich*. Jour. Cin. Soc. Nat. Hist., 6, 1883, p. 161, pl. vi, figs. 3, 3a
Stigmatella clavis, *Ulrich and Bassler*. Smith's Misc. Coll., Quart., 47, 1904, p. 34, pl. 10, fig. 4.
Stigmatella clavis, *Cumings*. 32nd. Ann. Rep. Dept. Geol. Nat. Res. Indiana, 1908, p. 881, pl. 24, figs. 2, 2a; pl. 25, fig. 3.

Zoarium growing parasitically, usually upon crinoid columns, but not infrequently on the stems of small branching bryozoa. In thickness it varies from .02 to .15 of an inch, the largest species seen being about one inch in length. Those growing upon the crinoid columns usually being club-shaped or subfusiform, while those upon other objects are variously and irregularly shaped. Surface presenting at intervals of .1 inch small clusters of cells a little larger than the average, which in a few specimens are slightly elevated above the general level of the surface. Cells of one kind only, rather unequal in size, and irregular in arrangement, with moderately thin walls, and an average diameter of 1/130th of an inch, while the diameter of those in the

groups seldom exceeds 1 100th of an inch. When in a good state of preservation zoarium has a characteristically hirsute appearance.

Longitudinal sections show a spiniform tubulus between nearly all of the thin and straight tube-walls. Their internal cavity is distinctly shown and comparatively large. Diaphragms are usually developed at remote intervals, though often wanting. No interstitial tubes have been observed.

In tangential sections the cells are seen to be thin-walled and of rather unequal size. Spiniform tubuli of moderate size are plentifully developed, placed at the cell angles, and often at points between, in which case the walls are forced into their respective cell cavities on each side. No special series of small cells are observed in these sections.

This species is most nearly allied to *S. ornata*, from which it differs principally in having more numerous spiniform tubuli, which are also much more conspicuous, both externally and internally. These differences will also apply to the other species.

Among the specimens collected from the Humbervale quarry are a few rather poorly preserved examples showing the club-shaped zoarium characteristic of *S.clavis*. Sections show that these zoaria are parasitic on stems of *Bythopora arctipora* and indicate some differences from any other of the species of *Stigmatella*.

The groups of larger cells characteristic of the species have not been observed owing to the poor state of preservation of the surface. Tangential sections show the numerous, fairly large, sometimes hollow acanthopores indenting the walls of the zooecia.

Vertical sections closely resemble those of *S.clavis*, in the rather irregular character of the zooecia and the evidence of a cavity in the acanthopores. Certain parts of the section show nothing to cause one to doubt the identity of our form with *S.clavis*, but in other parts, the occurence of chain-like mesopores in the immature region constitutes an important difference which might justify the removal of the form to *S.catenulata* with the rank of a variety. However, the club-like shape of the zoarium, and the general resemblance in section so strongly suggest *S.clavis* that it is thought best to provisionally refer the form to that species. If the description of *S. clavis* could be amended to include a few chain-like mesopores in certain parts of the immature region there would be little doubt as to the indentity of our specimens with the type of the species.

The collections contain also some specimens of *Stigmatella* encrusting on shells of brachiopods which in both vertical and tangential section can scarcely be distinguished from *S.clavis* as defined above, *i.e.* with a few chain-like mesopores in the immature region.

Locality.—16-foot level, Humbervale quarry.

No. 1183 H.R. Royal Ontario Museum of Paleontology.

Family BATOSTOMELLIDAE

Genus BYTHOPORA, *Miller and Dyer*

BYTHOPORA, *Miller and Dyer*. Contr. to Pal., No. 2, p. 6.

BYTHOPORA, *Nickles and Bassler*. Bull. U.S. Geol., Surv., 173, 1900, p. 32.

The amended description of this genus as given by Nickles and Bassler is as follows:

Zoarium ramose; branches usually slender, sometimes of considerable size: zooecia practically without diaphragms: apertures oblique, narrowing above; interspaces canaliculate; mesopores few; acanthopores comparatively strong, rarely more than one to each zooecium, sometimes wanting.

Bythopora arctipora (*Nicholson*)

Plate II, Fig. 12; Plate V, Figure 11; Plate VI, Figure 3.

Ptilodictya (?) arctipora, *Nicholson*. Annal. Mag. Nat. Hist. 4th series, 15, 1875, p. 180. pl. 14, figs. 4-4b; Pal. Ohio, 2, 1875, p. 262, pl. 25, figs 9-9b.
Bythopora arctipora, *Miller and Dyer*. Contr. to Pal., No. 2, p. 6, 1878.
Bythopora arctipora, *Cumings*. 32nd Ann. Rep. Dept. Geol. Nat. Res. Indiana, 1908, p. 780, pl. 8, fig. 8, pl. 26, figs. 15, 15a.

Nicholson's description is as follows:

Polyzoary forming a cylindrical, slightly branched frond, which is not sharp-edged, exhibits no non-celluliferous borders, and shows no traces of a central laminar axis. Cells arranged in obscurely longitudinal, alternating rows, apparently perpendicular to the surface, and radiating in all directions from an imaginary axis. Cell-mouths very much compressed, much longer than wide, expanded below, and attenuated superiorly, where they are often somewhat twisted and bent. Upon the whole the cells are pyriform in shape, with their narrow ends directed upwards, about eight in the space of one line measured vertically, and twelve in the same space measured diagonally. The cells are not always in contact, especially in their upper portion, and their borders are always distinctly marked off by impressed lines; but they are not arranged between elevated longitudinal lines. The margins of the cells are very thick and conspicuous, not granulated, tuberculated, or spinigerous.

The best preserved fragment had a length of eight and a half lines, dividing at its summit into two branches, its diameter being rather more than one-third of a line.

Delicate branching Bryozoa are among the commonest fossils both on the Humber and Don rivers but it is very seldom that the surface is well enough preserved to make the identification certain. There is no doubt, however, that most of the forms are referable to *B. arctipora*, but some, particularly on the Humber river, *may* be *B. delicatula*, Nicholson.

Locality.—Don Valley brickyard, Toronto; Lambton.

Nos. 1087 H.R., 1094 H.R., 1095 H.R. Royal Ontario Museum of Paleontology.

Bythopora *cf.* delicatula, *Nicholson*

Plate VI, Figure 4.

Chaetetes delicatulus, *Nicholson*. Quart. Jour. Geol. Soc. London, 30, 1874, p. 505, pl. 29, figs. 8-8b; Pal. Ohio, 2, 1875, p. 199, pl. 21, figs. 9-9a; Pal. Prov. Ontario, 1875, p. 30.
Monticulipora delicatula, *James and James*. Jour. Cin. Soc. Nat. Hist., 10, 1888 p. 178; Miller, N. A. Geol. Pal., 1889, p. 197, fig. 196.
Bythopora (?) delicatula, *Ulrich*. Cont. Micro. Pal., Cambro-Sil., pt. 2, 1889, p. 36.
Bythopora delicatula, *Whiteaves*, Pal. Fossils, 3, 1895, p. 116.
Bythopora delicatula, *Cumings*. 32nd Ann. Rep. Dept. Geol. Nat. Res. Indiana, 1908, p. 781, pl. 8, fig. 7; pl. 27, fig. 1.

Nicholson's original description of this species follows:

Corallum very slender and delicate, ramose, of cylindrical stems, which terminate sometimes in thickened, rounded extremities, and which in some cases appear to spring from a horizontal footstalk. Stems sometimes simple, more commonly bent, the divisions taking place dichotomously at acute angles. Diameter of the stems usually about half a line, sometimes a quarter of a line, rarely two-thirds of a line. Corallites very oblique to the surface of the coral, opening by oval apertures, the length of which corresponds with the long axis of the stem and uniformly exceeds the breadth. Calices in diagonal rows about eight in one line, measured longitudinally, and twelve to fourteen in the same space measured diagonally. The calices are all of equal size, and when perfect the lower lip is more or less thin and prominent. The surface is entirely devoid of monticules or elevations of any kind, and there are no very minute tubuli amongst the ordinary corallites.

Nicholson states that this species is one of the commonest fossils in the Hudson River group both in Canada and the United States and records its occurrence at Weston, Toronto, Credit river, Georgian bay etc. Nickles and Bassler give its horizon as Richmond and Ulrich found it on a slab from Stony mountain, Manitoba. The old collections of the University of Toronto contain many specimens from the

Humber river which were ascribed to this species but we are of the opinion that all of these, except one, are *Bythopora arctipora*. It seems unlikely that Nicholson could have confused two of his own species but we are forced to admit that we have been unable to identify *B. delicatula* in the very large collections made from the vicinity of Toronto. One specimen from Weston, figured herewith, has been recorded as *Bythopora gracilis* which it certainly is not. This form is more robust than *B. arctipora* and closely resembles specimens of *B. delicatula* from the Richmond of Oregonia, Ohio. This form is provisionally ascribed to the present species.

Locality.— Weston, Ontario.

No. 1096 H.R. Royal Ontario Museum of Paleontology.

Bythopora gracilis, *James*

This species of *Bythopora* is a ramose form, much more robust than either *B. arctipora* or *B. delicatula*. The apertures are oval to circular and are separated in part, by minute circular tubuli. As the species has been recorded from the district it is mentioned here but we have been unable to identify the form.

Family HALLOPORIDAE

Genus Hallopora, *Bassler*

Callopora, *Hall*. Pal. New York, 2, 1852, p. 144.
Callopora, *Nicholson*. Pal. Prov. Ont., 1874, p. 61; Geol. Mag., new series, 1, 1874, p. 13.
Callopora, *Hall*. 28th Ann. Rep. N.Y. State Mus., 1879, p. 114.
Callopora, *Ulrich*. Jour. Cin. Soc. Nat. Hist., 5, 1882, p. 154, 251.
Callopora *Cumings*. 32nd Ann. Rep. Dept. Geol. Nat. Res. Indiana, 1908, p. 741.
Hallopora, *Bassler*. Bull. U.S. Nat. Mus., 77, 1911, p. 325, 326.
Hallopora, *Bassler*. U.S. Nat. Mus., Bull. 92, 1915, p. 72. (See for complete synonomy).

Ulrich's amended description of the genus *Callopora* is as follows:

Zoarium usually ramose, the branches frequently anastomosing and forming bushy clumps; zooecia at first prismatic, four to eight sided, gradually becoming cylindrical in most cases; at first with closely set diaphragms, then diaphragms more distant, finally in the mature region diaphragms usually closely set; apertures closed at times by perforated, often ornamented covers; mesopores more or less numerous, angular, crowded with diaphragms.

Bassler (*op. cit.*) points out that the name *Callopora* was preoccupied by Gray with *Callopora lineata* as the type of the genus. In consequence of this he has proposed the name *Hallopora* to replace *Callopora* as used by Hall.

The rocks of Toronto contain at least three species of *Hallopora*, all ramose: in two cases, the surface is smooth or nearly so, and in the other case it is covered with distinct monticules. The larger of the smooth species is referred to *Hallopora subplana*, Ulrich, or to *H. onealli communis*, and the smaller to *H. onealli*. The one with monticules is herein regarded as a new variety of *H. dalei*, Milne-Edwards and Haime.

Hallopora *cf.* subplana (*Ulrich*)

Plate III, Figures 12 and 13; Plate IV, Figures 9, 13 and 14; Plate V, Figure 4; Plate VI, Figure 9.

Callopora subplana, *Ulrich*. Jour. Cin. Soc. Nat. Hist., 5, 1882, p. 253, pl. 11, figs. 7, 7b.
Callopora subplana, *J. F. James*. Jour. Cin. Soc. Nat. Hist., 16, 1894, p. 196.
Callopora subplana, *Cumings* 32nd Ann. Rep. Dept. Geol. Nat. Res. Indiana, 1908, p. 795, pl. 10, figs. 4, 4a; pl. 27, fig. 15.
Hallopora subplana, *Bassler*. U.S. Nat. Mus., Bull. 92, 1915, p. 583.

Ulrich's description is as follows:

Zoarium ramose, the branches cylindrical, from .2 inch to .5 inch in diameter, and divided dichotomously at intervals varying from .6 inch to 1 inch. Cells polygonal in unworn examples, subpolygonal or rounded in worn specimens. The surface exhibits clusters of from four to eight cells, that occasionally are slightly elevated above the general surface, and are conspicuously larger than the ordinary cells which surround them. The latter vary in diameter from one-seventieth to one-sixtieth of an inch (*i.e.* six to seven cells may be counted in the space of .1 inch), while those composing the clusters may attain a diameter of one-fortieth of an inch, though their usual diameter is only about one fiftieth of an inch. The interstitial cells are comparatively few, being most numerous and noticeable between the large cells of the clusters mentioned. Over the other portion of the surface they usually occur at the angles of junction of the ordinary large tubes. They are, however, always inconspicuous, and easily overlooked.

In longitudinal sections the tubes in the axial region of the zoarium have very thin, flexuous, and often crimped walls. Diaphragms are usually not developed here, except a few (6 to 9) in the young tubes just above the point of their origin. These are placed at distances apart equalling about two of their diameters at the point of crossing. As the tubes bend outward to reach the surface their walls are thickened, the interstitial tubes make their appearance, and numerous diaphragms are developed in the large tubes, the latter often inosculate, while the distance between them usually varies from one-fourth to one-half of the diameter of the tube crossed. The diaphragms in the interstitial tubes are always complete and equally crowded in all.

Tangential sections show that the tubes just below the surface have much thickened walls, their visceral chambers being rounded or oval. The walls of adjoining tubes are seemingly fused together, so that the original boundary line cannot be detected. The cavity of each tube is surrounded by a secondary deposit of dark, concentrically laminated sclerenchyma, while the original wall is represented by apparently structureless (in this section) sclerenchyma, of much lighter shade. The interstitial cells are variable in size and shape, and comparatively much reduced in numbers, being, as a rule, less numerous than the proper tubes.

The characters which distinguish *Hallopora subplana* from all other species of the genus known to me from the Cincinnati group, are found in its robust growth, the large size of the cells, the conspicuous clusters, and the proportional paucity of the interstitial tubes.

Robust, comparatively smooth, dichotomously branching bryozoans are of common occurrence in the quarry at the brickyard in the Don Valley. Hitherto we have been in the habit of ascribing these to *Dekanella ulrichi* which they very closely resemble superficially. In some hundreds of sections, however, no trace of acanthopores has been found which makes it impossible to include them in that species. The resemblance of most of these forms to *Hallopora subplana* is so great that little doubt remains as to their identity with that species. There are, however, some slight differences which must be enumerated. First, the cells are somewhat smaller: in the type they are less than three to the millimetre, while in our specimens they number at least four in that space. The clusters of larger cells are less conspicuous and somewhat nearer together than in the type: in some cases they can scarcely be made out, while in others they are observable to the naked eye as slight rounded monticules. The cells of the clusters, in the type occur to the number of two or a little less in the millimetre while in our specimens an average of three occur in that distance. The internal structure as revealed by sections conforms very closely to that of the type. Some of the larger specimens show a strong resemblance to *Hallopora onealli communis*, James, and as that species has been recorded from this locality its occurrence must be regarded as probable although we are unable to definitely state that we have observed it.

The general shape of the zoarium of average specimens is shown in Plate VI, Figure 9. Surfaces are nearly always clogged with shale or encrusted with pyrite making the taking of photographs very unsatisfactory: Plate V, Figure 4 was prepared from a slightly worn specimen.

Figure 14 of Plate IV is a tangential section very close to the surface: it shows well the clusters of larger cells, the scattered mesopores and the character of the cell-wall. Figure 13 of Plate III was drawn to show the size of the cells and mesopores without any attempt to represent the character of the tissue. Figure 13, Plate IV is a photograph and Figure 12, Plate III a drawing from the same vertical section. Figure 9, Plate IV is a photograph of a segment of a transverse section across a branch.

Locality.—Don Valley brickyard, Toronto.

Nos. 1097 H.R., 1098 H.R., 1099 H.R., 1100 H.R. Royal Ontario Museum of Paleontology.

Hallopora dalei *var.* subalta, *var. nov.*

Plate III, Figures 9 and 11; Plate IV, Figures 8, 10, 11, 12; Plate V, Figure 2, Plate VI, Figures 5 and 6.

Chaetetes dalii, *Milne-Edwards and Haime.* Pol. Foss. Terr. Pal., 1851, p. 266, pl. 19, figs. 6, 6a.

Monticulipora dalii, *Milne-Edwards and Haime.* Brit. Foss. Corals, 1854, p. 265.

Chaetetes approximatus, *Nicholson.* Pal. Ohio. 2, 1875, p. 193; pl. 21, figs. 3, 3a.

Monticulipora ramosa *var* dalei, *Nicholson.* Genus Monticulipora, 1881, p. 115, fig. 19, C, D, pl. 2, fig. 4.

Callopora dalei, *Ulrich.* Jour. Cincinnati Soc. Nat. Hist., 5, 1882, p. 252.

Callopora dalei, *Cumings.* 32nd Ann. Rep. Dept. Geol. Nat. Res. Indiana, 1908, p. 792, pl. 8, fig. 11; pl. 27, fig. 12.

Hallopora dalei, *Bassler.* U.S. Nat. Mus., Bull. 92, 1915, p. 579 (See for more complete synonymy).

Milne-Edwards and Haime's description (*op. cit.*) is as follows:

Polypier dendroide, à rameaux cylindriques, larges de 6 à 8 millimètres présentant à leur surface de petits mamelons coniques saillants distants de 2 ou 3 fois leur diamètre. Calices à bords un peu épais, subégaux, subcirculaires, n'ayant, qu'un tiers ou même un quart de millimètre.

This species was redescribed by Nicholson in his work on the Genus Monticulipora as a variety of *Callopora ramosa* as follows:

Not having had the opportunity of examining the original specimens upon which Milne-Edwards and Haime founded their *Chaetetes Dalii*, I cannot be absolutely certain that I have correctly identified it. Judging, however, from their figures and descriptions, I have little doubt that the form which I described as *Chaetetes approximatus* (Quart. Jour. Geol. Soc., vol. 30, p. 502, pl. 29, figs. 3, 3a, 1874) is really the same. Accepting his conclusion, the differences and resemblances between *Monticulipora ramosa*, D'Orb., and *M.Dalii*, E. and H., may be briefly stated as follows: As regards external characters, *M. Dalii* precisely agrees with the type form of *M. ramosa*, D'Orb., except that the monticules are much reduced in size, and that the interstital tubuli are sometimes not quite so conspicuous or numerous. The monticules are no longer boldly prominent or conical, but are much smaller, and in general either gently rounded or somewhat elongated transversely. With the above slight external difference, there is associated a complete agreement in internal structure, both tangential and longitudinal sections showing features precisely similar to those exhibited by corresponding sections of typical examples of *M. ramosa*, D'Orb. I cannot doubt, therefore, that as in the case of the so-called *M. rugosa*, E. and H., we have to deal in *M. Dalii*, E. and H., with nothing more than a well marked variety of *M. ramosa*, D' Orb.

Cumings (*op. cit.*) while retaining *Callopora dalei* as a distinct species adopts Nicholson's view as follows:

In internal characters there is no particular difference between this form and *C. ramosa*. Externally it differs only in the small size of the monticules, and even in this particular it is an easy matter to find transitional forms between *C. dalei* and *C. ramosa*.

The description given by Nicholson for *Chaetetes approximatus* which is regarded as identical with *Hallopora dalei* is as follows:

Corallum composed of cylindrical stems, from one and a half to nearly three lines in diameter, dividing dichotomously at short intervals. Corallites tolerably thick-walled, oval, sub-circular, or polygonal in shape, some eight to ten in the space of one line, often with excessively minute corallites interspersed amongst them, though these are rarely as abundant as in the preceding forms (*Chaetetes dalei* and *Chaetetes rugosus*), and may be nearly absent. Surface exhibiting a number of small conical or somewhat transversely elongated eminences, which are very slightly elevated above the general surface. These eminences are placed in irregular diagonal rows, separate about half a line transversely and two-thirds of a line measured vertically, and they are either solid at their summits, or carry a few excessively small cylindrical tubii, with or without one or more of the ordinary corallites.

Among the commonest fossils in the exposures on the Don river is a ramose monticulose bryozoan very closely allied to if not identical with *Hallopora dalei*. It occurs in association with *Hallopora subplana* and might be mistaken for examples of that species in which the monticules are unusually well developed. It can always be distinguished, however, by the smaller size of the apertures and the greater number of mesopores. Externally and internally this form approaches very close to *Hallopora dalei* but it differs in the degree of development of the monticules in so constant a manner that we feel justified in considering it as a distinct variety. When compared with typical examples of *H. dalei* from the Cincinnati district it is found in every instance that the monticules are lower and less pointed than in that species. In fact, the development in this respect is intermediate between that of typical *H. dalei* and that of *H. andrewsi*. In this latter species a stellate arrangement of the larger cells is a distinguishing feature: such arrangement, but much less pronounced, is also to be observed in our variety. This feature is not characteristic of *H. dalei*. For two reasons, therefore, our variety is intermediate between typical *H. dalei* and *H. andrewsi*, but it is impossible to ascribe it to the latter species on account of the large number of mesopores.

The general appearance of typical fragments is shown in Plate VI, Figure 6; the surface highly magnified is shown in Figure 5 of this plate and also by photographic reproduction in Plate V, Figure 2. The tangential section, Plate IV, Figure 8, shows the smaller size of the zooecial apertures and the greater number of mesopores as compared with Figure 14 of *H. subplana*. The margins of this figure show the tubes cut diagonally as the section passes into the monticules. Figure 10 of this plate shows a shallow tangential section highly magnified to illustrate the character of the tissue. Vertical and transverse sections are shown in Figures 11 and 12. Figure 9 of Plate III was drawn to show the size and arrangement of the cells without reference to the character of the tissue. Figure 11 is a drawing from the same section as Plate IV, Figure 12.

Locality.—Don Valley brickyard, Toronto.
No. 1101 H.R. Royal Ontario Museum of Paleontology.

HALLOPORA O'NEALLI, *var.* (*James*)

CHAETETES? O'NEALLI, *James*. Introd. Catal. Low. Sil. Foss., 1875, p. 2.
MONTICULIPORA O'NEALLI, *James and James*. Jour. Cin. Soc. Nat. Hist., 10, 1888, p. 174; *J. F. James*. Ibid., 16, 1894, p. 194.
CALLOPORA O'NEALLI, *Miller*. N. A. Geol. Pal., 1889, p. 296.
CALLOPORA O'NEALLI, *Bassler*. Proc. U. S. Nat. Mus., 30, 1906, p. 23, pl. 6, figs. 1, 2.
CALLOPORA O'NEALLI, *Cumings*. 32nd. Ann. Rep. Dept. Geol. Nat. Res. Indiana, 1908, p. 786, pl. 9, figs. 3, 3b; pl. 27, figs. 9, 10.

This rather variable species was originally defined by James as follows:

Corallum dendroid; slender cylindrical branches, dividing, generally dichotomously at irregular distances, and in some cases anastomosing; branches from half a line to two lines in diameter. Calices generally oval, but is some cases the variation may be from subcircular to polygonal, and from eight to ten in the space of a line, measuring lengthwise of the stem, varying considerably in size, occasionally one much larger than the average. Walls of corallites rather thick; minute tubes often between the apertures. The increase of corallites seems to be by fission. A cut section shows the stronger corallites as starting at the centre, growing parallel with the length of the stem and following the direction and dividing with the branches, the outer ones curving to the surface obliquely, although the apertures appear to be direct.

From the above description it would appear that *H. onealli* is a ramose type of the genus with branches of small diameter but apparently up to 4 mm., without maculae, monticules or clusters of larger cells, with numerous mesopores and with many diaphragms in both zooecial tubes and mesopores. The most characteristic features are the relatively short length of the zooecial tubes in the thickened mature region and the considerable slope at which they approach the surface.

Several varieties of *H. onealli* have been described: these are based to some extent on mere difference of size but in certain cases on more reliable features.

The rocks at Toronto, both on the Humber and on the Don, show many examples of a branching bryozoa, coarser than *Bythopora arctipora*, and finer than *Hallopora subplana* but varying considerably in diameter, and in the manner of bifurcation. These forms we have ascribed to *Hallopora onealli* after submitting typical sections to Dr. Ray S. Bassler of the United States National Museum. Dr. Bassler makes the following comment on the sections. "*Hallopora onealli* and its varieties are so abundant that the species as now understood has rather wide limits. Your slides indicate one of the varieties with smaller zooecia than the typical form."

Locality.—Cliff on west side of Humber river at Weston.
No. 1192 H. R. Royal Ontario Museum of Paleontology.

Sub-order CRYPTOSTOMATA
Family PTILODICTYONIDAE.
Genus ARTHROPORA, *Ulrich*

ARTHROPORA, *Ulrich*. Jour. Cincinnati Soc. Nat. Hist., 5, 1882, p. 152.

The original description of this genus is as follows:

Zoarium jointed, segments short, with several branches or spurs projecting from each edge. Cell apertures sub-circular, separated by interstitial pits or sulci, and occasionally closed by an operculum.

ARTHROPORA SHAFFERI (*Meek*)

Plate II, Figure 11; Plate V, Figure 5.

PTILODICTYA (STICTOPORA) SHAFFERI, *Meek*. Proc. Acad. Nat. Sci. Philadelphia, 1872, p. 317; Pal. Ohio, 1, 1873, p. 69, pl. 5, figs 1a-c.
PTILODICTYA SHAFFERI, *Nicholson*. Pal. Prov. Ont., 1875, p. 33, fig. 4.
STICTOPORA SHAFFERI, *Lesley*. Geol. Surv. Pennsylvania, Rep. P4. 1890, p. 1069.
ARTHROPORA SHAFFERI, *Ulrich*, Jour. Cincinnati Soc. Nat. Hist., 5, 1882, p. 167, pl. 7. figs. 10-10a.
ARTHROPORA SHAFFERI, *Bassler*. U. S. Nat. Mus., Bull. 92, 1915, p. 72. (See for full synonymy).

Meek's description of this species follows:

Polyzoum small and delicate, consisting of slender compressed divisions that give off on each side, rather closely arranged, regularly alternating, lateral branches of the same breadth as the main stem, from which they diverge at an angle of about 40°; lateral branches, in the same way, giving off on each side, very short, lobe-like, alternating projections; flattened lateral margins of all parts very narrow, sharp and minutely striated longitudinally, in well-preserved specimens; pores apparently without raised margins, more or less oval longitudinally, alternately disposed in longitudinal and oblique rows, so as to present a quincuncial arrangement; the number of longitudinal rows varying from five to about seven in the breadth of a stem or branch; spaces between the pores measuring transversely to the stems and their divisions about equal to the breadth of the pores, but greater, measuring in the direction of the oblique and longitudinal rows all ornamented, in perfectly preserved specimens, by very minute, more or less waved or flexuous striae.

Size of entire polyzoum unknown; breadth of stems and branches, 0.05 inch; number of pores in 0.05 inch, measuring in the direction of the oblique rows about 4 or 6, and in the same space measuring longitudinally from 3 to 4.

This very delicate little species will be readily distinguished from the other known Silurian (Ordovician) forms by its small size and its peculiar plumose mode of growth; and particularly by its very minute striae between the pores.

Concerning this species, Ulrich (*op. cit.*) makes the following remarks:

Meek's description of this species is in the main correct, but he did not notice that the zoarium is a jointed one. I have in my cabinet a specimen which preserves no less than forty of the segments in connection.

Nothing need be added to the above descriptions. The occurrence of this species on the Credit river was recorded by Nicholson, and Foerste mentions it in his list of fossils from the Don valley. The species is rather rare in this locality.

Locality.—Don Valley brickyard.

No. 1102 H.R. Royal Ontario Museum of Paleontology.

Sub-order CHEILOSTOMATA

Genus PALESCHARA, *Hall*

PALESCHARA, *Hall*. 26th Ann. Rep. New York State Mus., 1874, p. 107.
PALESCHARA. *Bassler*. U.S. Nat. Mus., Bull. 92, 1915, p. 941. (See for synonomy.)

Hall describes the genus as follows:

Bryozoum parasitic, or free, forming incrustations upon the surfaces of other fossils, or in independent frondose expansions. Surface with polygonal cellules, separated by thin solid walls; without evidence of rays or transverse septa.

Ulrich (Cincinnati Soc. Nat. Hist., 5, p. 157) adds the following:

Zoarium incrusting; tubes very short. Cell-apertures direct, angular, and more or less oblong.

PALESCHARA BEANI (*James*)

Plate III, Figures 10, 10a; Plate V, Figure 7.

CERAMOPORA (?) BEANI, *James*. Paleontologist, No. 1, 1878, p. 5; Jour. Cincinnati, Soc. Nat. Hist., 7, 1884, p. 23, figs. 3-3b.
PALESCHARA BEANI, *Ulrich*, Amer. Geol., 1, 1888, p. 186.
PALESCHARA BEANI, *Bassler*. Proc. U.S. Nat. Mus., 30, 1906, p. 46.
PALESCHARA BEANI, *Bassler*. U.S. Nat. Mus., Bull. 92, 1915, p. 942.

James describes the species as follows:

Polyzary forming thin, irregular expansions, parastic upon the surface of *Orthoceras*, and probably other foreign substances. Sometimes in colonies, in other cases completely covering the body of sections of *Orthoceras*. The cells have, sometimes, eccentric points from which they radiate, and are arranged in a somewhat quincuncial order in alternating oblique rows; but in other cases they are not so regularly disposed. Cell-walls rather thick and not raised above the general surface; apertures slightly oblique in some cases. Cell-apertures generally

long oval or diamond-shaped, but sometimes quite irregular in form. The best specimens show, occasionally, minute pores at the angles or junctions of some of the cell-walls. About three cells in the space of a line measuring the longer diameter, and four or five measuring transversely, except at the radiating points, where they are smaller. In some examples the cells and cell-walls resemble the non-poriferous face of the fenestrules and branches of *Retipora*, but much smaller than any specimens noticed of that genus.

This species occurs, but infrequently, in the rocks of the Don Valley brickyard. The specimen used for illustration covers the surface of a fragment of *Orthoceras* 25 mm. wide by about 40 mm. long.

Locality.—Don Valley brickyard, Toronto.
No. 1103 H.R. Royal Ontario Museum of Paleontology.

Conclusion

All the forms of *Bryozoa* which we have been able to recognize in our rather extensive collections are described above but it is very likely that many species have been overlooked. This is in part due to insufficient material and in part to the fact that specimens from the shale seldom present surfaces sufficiently well preserved to justify identification: it is not until sections are prepared that a degree of certainty is arrived at: this is particularly true of the various species of *Stigmatella*.

As other species have been recorded from Toronto rocks it is necessary to include here a short revision of previous publications on the subject.

Report upon the Paleontology of the Province of Ontario—by Henry Alleyne Nicholson

Besides certain of the species already described, Nicholson refers to the following:

Chaetetes fletcheri, Nicholson—Synonym for *Dekayella ulrichi*, Nicholson. As already stated, we are of the opinion that most, if not all, of the specimens referred to this species are really *Hallopora subplana*.

Chaetetes petropolitanus, Pander—Considered as a synonym of *Mesotrypa whiteavesi*, Nicholson. This is a Trenton species and is unlikely to occur at Toronto and Weston as stated by Nicholson. We are of the opinion that Nicholson had in hand some of the forms which we have ascribed to *Stigmatella*.

Chaetetes discoideus, James—Synonym for *Amplexopora discoidea*. Nicholson states that this form is not uncommon at Weston and our older collections contain specimens so labelled. While we would hesitate to deny the occurrence of the species we have found that those discoidal bryozoans which we have sectioned do not belong to the genus *Amplexopora*.

Chaetetes undulatus hemisphericus, James—Synonym for *Monotrypa undulata hemispherica*. The genus *Monotrypa* has no acanthopores and Nicholson makes no mention of these structures in his description of the "puff-ball" fossils. All our sections of these variable bryozoans show more or less development of acanthopores on which account we have removed them to *Stigmatella*. It is possible that *Stigmatella crenulata* is identical with or allied to *Monotrypa undulata hemispherica*.

Upper Ordovician Formations of Ontario and Quebec—by A. F. Foerste

Most of the *Bryozoa* mentioned by Foerste have been identified in our collections and described above. The only forms requiring comment are as follows:

Spatiopora maculosa, Ulrich—Recorded from the Don brickyard. This is probably the same species which we have described as *S. varians*.

Hallopora communis, James—Synonym for *Hallopora oneilli communis*. Identified by Ulrich and recorded by Foerste as occurring in the Don Valley quarry. We have been unable to indentify this form with certainty from the material in our collections. In view of the eminent authority for its occurrence the species must be listed among the fossils from the Don valley.

Twelfth International Geological Congress, Guide Book 6.

The list here given was compiled from specimens in the collections of the Royal Ontario Museum. A critical examination of this material compels the following corrections.

HETEROTRYPA FRONDOSA, *D'Orbigny*. Mistaken identification for PERONOPORA VERA.
HETEROTRYPA INFLECTA, *Ulrich*. Not recognized.
HEMIPHRAGMA WHITEFIELD, *James*. Not recognized.
LEPTOTRYPA IRREGULARIS, *Ulrich*. Probably LEPTOTRYPA EXPANSA.

BRACHIOPODA

A description of the different species follows:

Order ATREMATA

Family LINGULIDAE

Genus LINGULA, *Bruguière*

LINGULA, *Bruguière*. Encyclopédie Méthodique, 1, 1792, pl. 250.
LINGULA, *Hall and Clarke*. Pal. New York, 8 pt. 1, 1892, pp. 2, 161
LINGUDA, *Bassler*, U. S. Nat. Bull. 92, 1915, p. 724. (See for complete synonymy).

The description of the genus *Lingula* according to Hall and Clarke follows:

Shells sub-equivalve, equilateral; elongate-ovate, subquadrate or subtriangular in outline; broad over the pallial region, cardinal slope more or less conspicuous; slightly gaping at both extremities. Brachial or dorsal valve somewhat the shorter, and with a slightly thickened hinge line. Surface of the shell smooth, or concentrically and radiately straited. Animal attached by a long, muscular pedicle protruding from between the beaks of the two valves.

LINGULA WESTONENSIS, *sp. nov.*

Plate VII, Figure 1.

A species of *Lingula* which we have been unable to ascribe to any described form occurs occasionally on the Humber river. While this species resembles somewhat *Lingula obtusa*, Hall, it seems to differ sufficiently to justify the creation of a new species.

The outline of the shell is distinctly ovate with the maximum diameter about one-third of the length from the anterior margin. The concentric markings conform with the outer margin: they are fairly sharp laterally but posteriorly and medially they are less numerous and less defined and more of the nature of undulations. Posteriorly there is evidence of a slight median scar. As already stated this form resembles *Lingua obtusa*, Hall, but differs in being slightly more elongate. From *L. progne*, Billings, it can be distinguished by the less quadrangular form and the fainter median scar.

Length of type 12 mm., width 8 mm.

Locality.—West side of Humber river below bridge at Weston, Ontario.
No. 1079 H.R. Royal Ontario Museum of Paleontology.

Lingula *cf.* progne, *Billings*

Plate VII, Figure 2.

Lingula progne, *Billings*. Pal. Fossils, 1, Geol. Sur. Canada, 1865, p. 47, fig. 50.
Lingula progne, *Billings*. Geol. Canada, 1863, p. 151, fig. 134; p. 201, fig 196.
Lingula progne, *Bassler*. U.S. Nat. Mus., Bull. 92, 1915, p. 732.

The commonest species of *Lingula* found at Toronto resembles very closely the figures given by Billings for *L. progne* the description of which follows:

Shell oblong-oval; both valves gently and uniformly convex; front margin broad and rounded or somewhat straight; anterior angles rounded; sides and the anterior two-thirds of the length with the exception of the anterior angles straight or gently convex, parallel; in the posterior third converging with a slightly convex slope to the beak. The ventral valve is somewhat pointed at the beak with an apical angle of about 70 degrees; the apex of the dorsal valve is obtusely rounded. Surface with concentric undulations, more numerous in some specimens than in others. In addition to these there are fine concentric striae and longitudinal radiating lines, the latter not visible at shining.

In the above description Billings makes no mention of the presence of a pronounced median scar but all his figures show this feature and it has been customary to make use of this peculiarity in identifying specimens of the species from the Collingwood and Utica formations. The presence of this scar is probably due to a pronounced median septum.

On the basis of the description alone one would have no difficulty in ascribing our forms to *L. progne*, but, although numerous specimens are available, only the slightest trace of a median scar is to be seen.

The figure of the brachial valve has been drawn from a Toronto specimen but the median scar has been added in accord with Billing's figure. The pedicle valve is considerably more pointed and specimens are frequently found showing its beak and the tract of the peduncle extending beyond the apex of the brachial valve.

Locality.—Don brickyard, Toronto.

No. 1104 H.R. Royal Ontario Museum of Paleontology.

Sub-genus Pseudolingula, *Mickwitz*

Lingula (Pseudolingula) rectilateralis, *Emmons*

Plate VII, Figure 3.

Lingula rectilateralis, *Emmons*. Geol. New York, Rep. 2nd Dist., 1842, p. 399 fig. 6.
Lingula rectilateralis, *Foerste*. Bull. Sci. Lab. Denison University, 17, 1914, p. 254.
Lingula quadrata, *Hall*. Pal. New York, 1, 1847, p. 96, pl. 30, fig. 4; p. 285 pl. 79, fig. 1.
Lingula rectilateralis, *Ruedemann*. New York State Mus. Bull., 162, 1912, p. 91, pl. 4, fig. 1.

Hall's description of this species is as follows:

Equivalve, equilateral, broadly oval, depressed-convex; sides nearly straight and parallel, or slightly curved; extremities nearly equal in width, the first broadly rounded cardinal extremities slightly narrower and somewhat angularly sloped; beak marginal, not prominent; exterior surface of the shell marked by strong concentric striations, and along the middle by distinct longitudinal striae, which are equally visible when the outer shell is exfoliated. A longitudinal depressed line marks the shell from the beak nearly half way to the base.

This species is perhaps the largest fossil *Lingula* known: it is distinguished by its general elliptical form and nearly parallel sides. In its dimensions it is near the *Lingula lewisii*, Sowerby; but is more regularly rounded at the base, and does not preserve the square outline which that shell has. Our largest specimen is one inch and a half in length, with a width of almost an inch.

The usual length of this shell is one inch, and its great size alone is commonly sufficient to distinguish it from any other species in our strata. The longitudinal striae mark only the central part of the shell, and are equally distinct when the shell is exfoliated: this character may be useful in detecting this species.

Our collections contain only two specimens from the Don valley which we venture to ascribe to this species. In general shape they approach very closely to Hall's description and figures but there is no trace of the longitudinal striations on which he lays stress, and the size is considerably less. The figure given by Ruedemann, however, is without longitudinal striations and is indistinguishable from our specimens. Length, 15.8 mm.; width anterior, 10.7 mm.; width posterior, 9.3 mm.

Locality.—Don brickyard, Toronto.

No. 1105 H.R. Royal Ontario Museum of Paleontology.

Order NEOTREMATA

Family TREMATIDAE

Genus SCHIZOCRANIA, *Hall and Whitfield*

SCHIZOCRANIA, *Hall and Whitfield.* Pal. Ohio, 2, 1875, p. 71.

SCHIZOCRANIA, *Hall and Clarke.* Pal. New York, 8, pt. 1, 1892, pp. 142, 168.

SCHIZOCRANIA, *Cumings.* 32nd Ann. Rep. Dept. Geol. and Nat. Res. Indiana, 1907, p. 894

The description given by Hall and Whitfield follows:

Among the unarticulated brachiopods of the Silurian formation there is a group of radiatingly striated shells, which may be typified by *Orbicula? filosa*, Hall, Pal. New York, Vol. 1., p. 99, pl. XXX, fig. 9, which have usually been referred to the genera *Discina* and *Trematis*, but which do not exactly correspond in character to either of those genera. They differ from *Discina*, and also from *Orbiculoidea* in several particulars; among which may be mentioned the striated surface, the marginal beak of the upper valve, and the widely divided posterior margin of the lower valve, which forms a deep marginal notch, instead of an eccentric foramen or perforation, as in those genera. The lower valve in this group is firmly fixed and cemented to foreign substances, while those of the above genera are free, the whole being attached only by a byssus passing through the foramen of the lower valve. The substance of the shell is also of a much more calcareous nature, if not entirely so. The features as at present known are given in the following diagnosis: Unarticulated, inequivalve, brachipodous shells, growing parasitic on foreign bodies, to which they are attached by the close adhesion and anchylosis of the external or inferior surface of the lower valve. Lower valve flat or conforming to the surface to which it adheres; deeply notched on the posterior side of the centre, the notch extending from a point more or less distant from the centre of the valve to the posterior margin, where the sides of the slit are widely and distantly separated. Upper or free valve more or less convex, and having a beak terminal on the posterior margin. Surface of the upper valve radiatingly striated in the typical species; the lower valve concentrically wrinkled. Muscular imprints of the free valve, six known; two of which are situated near the rostral portion of the valve, large, ovate, and diverging; two minute, approximate just below and between the former; and two of medium size, circular, distant from each other, and situated near the centre of the valve. Those of the lower valve unknown. The striated surface, widely notched lower valve, and parasitic habits are the strong distinctive points.

SCHIZOCRANIA FILOSA (*Hall*)

Plate VII, Figures 4 and 5.

ORBICULA ? FILOSA, *Hall.* Pal. New York, 1, 1847, p. 99, pl. 30, fig. 9.

ORBICULOIDEA FILOSA, *Emmons.* Amer. Geol., 1, pt. 2, 1855, p. 200, pl. 8, fig. 9.

CRANIA FILOSA, *Hitchcock.* Geol. Vermont, 1, 1862, p. 292, fig. 196.

OBOLUS FILOSUS, *Safford.* Geol. Tennessee, 1869, p. 276, fig. 9.

TREMATIS FILOSA, *Billings*. Geol. Canada, 1863, p. 159. fig. 126.
SCHIZOCRANIA FILOSA, *Hall and Whitfield*. Pal. Ohio. 2, 1875. p. 73. pl. 1. figs. 12-15.
SCHIZOCRANIA FILOSA, *Cumings*. 32nd Ann. Rep. Dept. Geol. Nat. Res. Indiana, 1908, p. 933. pl. 34. figs.8 and 8a.
SCHIZOCRANIA FILOSA, *Foerste*. Bull. Sci. Lab. Denison, Univ., 16, 1910, p. 40.

The original description of this species is given below:

Shell orbicular, or very slightly ovate, the beak of the upper or free valve projecting a little beyond the limits of the circle, giving a somewhat greater diameter along the median line than in a transverse direction. Free valve moderately convex, the central region being the most prominent. Attached valve discoid, very thin, deeply and broadly notched on the posterior side; the notch not extending quite to the centre of the valve; occupying nearly one quarter of the circumference of the valve on the outer margin; border of the notch thickened, especially at the base, which is rounded, and the centre marked by a slightly projecting point. Interior of the free valve marked by two proportionally large, elongate ovate, diverging muscular prominences, leaving corresponding pits on the casts of the shell, or on exfoliated specimens; situated just below the beak, and extending for nearly or quite one fourth of the length of the valve from the apex. There are also two other muscular impressions somewhat smaller in size, circular in form, and situated near the middle of the valve below the extremities of the ovate imprints, and slightly more distant from each other. Beneath the beak there is a slight thickening of the cardinal border. The muscular markings of the lower valve have not been observed.

Surface of the shell of the convex valve marked by fine, even, threadlike, radiating striae; increased both by division and implantation, and gradually increasing in strength toward the border of the shell; the interspaces where the shell is perfectly preserved are flattened, the striae appearing as raised lines on the surface. The attached valve is strongly marked by irregular concentric undulations circling the valve parallel to the margin, but interrupted at the border of the notch.

This species is of somewhat rare occurrence in the shales of the Don valley. Fairly good examples of the brachial valve are contained in our collections but we have no material illustrating the pedicle or attached valve. Dimensions of form figured; length, 13.8 mm., width, 13.2 mm.

Locality.— Don Valley brickyard, Toronto.
No. 1106 H.R. Royal Ontario Museum of Paleontology.

Genus TREMATIS, *Sharpe*

TREMATIS, *Sharp*. Quart. Jour. Geol. Soc. London, 4, 1848, pp. 66, 68.
TREMATIS. *Hall and Clarke*. Pal. New York, 8, pt. 1, 1892, pp. 138, 168.
TREMATIS, *Cumings*. 32nd Ann. Rep. Dept. Geol. Nat. Res. Indiana, 1908, p. 895.

The description given by Hall and Clarke is as follows:

Shell subcircular or transversely oval in outline. Pedicle valve unevenly convex, more or less depressed over the posterior region; apex at, or behind, the centre; directly beneath it begins the pedicle fissure, which transects the shell, vertically widening to the posterior margin with straight or outwardly curving edges. Brachial valve evenly convex, with its apex marginal and slightly projecting. On the interior, the pedicle valve shows a faint median furrow extending from the angle of the fissure to the apex of the shell; this groove widens at its apical termination and may represent a point of muscular attachment. The sides of the fissure are often thickened by callosities similar to those sometimes seen in species of *Orbiculoidea*. From the apex of the valve extend radiating and branching vascular sinuses.

In the brachial valve the posterior margin is much thickened and broadly grooved to allow the extrusion of the pedicle. This thickening does not take the form of a cardinal area or shelf, but is rather a callosity closely appressed against the interior surface of the shell, the central portion being projected beyond the margin of the pedicle valve. Directly below and in front of this area are two transversely elongate scars, adjustors or posterior adductors, which are usually partly concealed by the progressive overgrowth of the cardinal thickenings. A faint median septum begins between these scars and passes forward, becoming more prominent over the tongue-shaped median elevation which separates the large central scars. These impressions

are oblique and are not simple, each appearing to be composed of two, if not three distinct scars, making a posterior, a median and an anterior pair. What appears to be the posterior pair is small, and sometimes quite sharply defined, the central pair very much larger, and the anterior pair narrow, situated at either side of the angle of the median callosity and separated by its apex. The specialization of the first of these scars is not satisfactorily established; the entire impression is deeply excavated. In some well-preserved specimens, there is also evidence of external, marginal scars lying just in front of the outer ends of the posterior adductors.

Surface of both valves more or less completely covered by a beautiful ornamentation consisting of punctures or small pittings of varying depth, arranged either in a quincunx or in radiating rows; in the latter case they may be distant from one another without intervening ridges, or lie in radiating furrows, when they are either circular or sub-rectangular.

Shell substance composed of an outer calcareous layer with a series of inner corneous lamellae. The outer layer varies in thickness in different species and is coarsely punctated by the pittings constituting the surface ornamentation. The corneous layers are impunctate.

Trematis millepunctata, *Hall*

Plate VI, Figure 1; Plate VII, Figures 7 and 8.

Trematis millepunctata, *Hall.* Desc. New Species Crinoids and other Fossils. 1866, p. 14.

Trematis millepunctata, *Hall and Whitfield.* Pal. Ohio, 2, 1875, p. 70, pl, 1, figs. 4-7.

Trematis millepunctata, *Hall.* 24th Rep. New York State Cab. Nat. Hist., 1872, p. 221, pl. 17, figs. 22-25.

Trematis millepunctata, *Cumings.* 32nd Ann. Rep. Dept. Geol. Nat. Res. Indiana, p. 943, pl. 34, figs. 9-9a.

The original description of this species is quoted below:

Shell small, suborbicular, transverse on the ventral side and lenticular in profile. Ventral valve strongly convex below the middle, more depressed above; with a narrow deeply depressed pedicle-opening, the margins of which are flattened for a space nearly equal to the breadth of the opening. Dorsal valve more elongate, most convex above the middle; the beak pointed and projecting considerably beyond the opposite valve; with a depressed or concave triangular area. Interior of the dorsal valve marked near the middle by two comparatively large semicircular or reniform muscular scars, the breadth across the two more than equal to one-third the diameter of the valve; the centre of the valve has also a slight mesial septum.

Surface strongly punctate in concentric curves passing from the centre of the shell outwards, extending through the shell near the front of the valves, and distinctly marking the cast: inner layers of the shell not punctate.

Trematis millepunctata is fairly common in the shale beds at Toronto but perfect specimens are exceedingly rare. Very small fragments, however, suffice for its identification on account of the distinctive ornamentation. The figures are composite drawings founded on four different specimens.

Locality.—Don brickyards, Toronto.
No. 1107 H.R. Royal Ontario Museum of Paleontology.

Trematis ottawaensis, *Billings*

Trematis ottawaensis, *Billings.* Geol. Surv. Canada, Pal. Foss. 1, 1865, p. 53, fig. 58.

Trematis ottawaensis, *Bassler.* U.S. Nat. Mus., Bull. 92, 1915, p. 1280. (See for more complete synonymy.)

This species of *Trematis* is very clearly defined by the character of the ornamentation which is thus described by Billings:

Surface with fine, radiating striæ, which increase by interstitial addition, sometimes closely crowded together, in which case there are ten or twelve in the width of a line; occasionally more distant, or from four to eight in one line. The intermediate grooves are divided into square compartments by cross ridges, which connect the radiating

ridges, but are not continuous, those in one groove not corresponding in position with those in the adjacent grooves, so as to form uninterrupted concentric lines. In specimens with the striae closely crowded together, only the radiating lines are distinctly visible, but the others can always be detected in good specimens, on close examination.

It is with some hesitation that this species is recorded from the rocks at Toronto. We have a single specimen, the indentification of which is reasonably certain, but the locality of occurrence is open to question. The specimen was found in the old collections, labelled "*Trematis millepunctata*, Humbervale quarry, Toronto, collected by J. Townsend." In view of the fact that not another trace of the species has been found, and admitting the possibility of a misplaced label, it seems advisable not to definitely record the occurrence of the species.

Locality.—Humbervale quarry, Toronto.
No. 1162. R. H. Royal Ontario Museum of Paleontology.

Family CRANIIDAE

Genus PHOLIDOPS, *Hall*

PHOLIDOPS, *Hall*. Pal. New York, 3, 1859, p. 489.
PHOLIDOPS, *Hall and Clarke*. Pal. New York, 8, pt. 1, 1892, p. 155.
CRANIOPS, *Hall*. 12th Rep. New York State Cab. Nat. Hist., 1859, p. 84.
PHOLIDOPS, *Schuchert*. Zittel-Eastman Text Book of Pal., p. 379.

The description as given by Hall and Clarke follows:

Shells small, patelliform, equivalve, equiconvex, inarticulate, unattached. Outline oval or subelliptical; apex subcentral, excentric or marginal, sometimes terminal and produced. Surface marked by strong, concentric, often lamellose lines of growth, which are crowded on the posterior, and distant on the anterior portions of the valves; these are sometimes crossed by faint interrupted radiating lines. In the interior the surfaces of contact make a broad smooth, flat or slightly convex border, somewhat broader in front than behind. The muscular and visceral area occupies a sharply defined and very limited space in the apical portion of each valve. In both valves it is essentially of the same size and subtriangular in outline, the apex of the triangle pointing forward and usually surrounded by a conspicuous callosity.

The ventral (?) valve bears two well-defined central adductors occupying the same relative position as in *Crania;* these impressions are usually simple, but appear to be sometimes complicated by association with ill-defined scars of the anterior muscles. The posterior adductors or divaricators are situated at the basal angles of the muscular triangle, and are distant from the posterior margin. The linear parietal scars are very strong, the posterior being more or less distinctly lobate, the anterior generally straight or rounding about the central adductors. In the opposite or dorsal (?) valve the scars have essentially the same arrangement; the anterior adductors, however, are separated by elongate median scars (anteriors) which traverse the elevated callosity surrounding the anterior margin of the area. The posterior scars are often more widely divergent than in the other valve. Shell substance calcareous and impunctate (?).

PHOLIDOPS CINCINNATIENSIS, *Hall*

Plate VII, Figure 6.

PHOLIDOPS CINCINNATIENSIS, *Hall*. 24th Rep. New York State Cab. Nat. Hist., 1872, pl. 7, fig. 10.
PHOLIDOPS CINCINNATIENSIS, *Meek*. Pal. Ohio, 1, 1873, p. 130, pl. 5, fig. 2.
PHOLIDOPS CINCINNATIENSIS, *Bassler*. U.S. Nat. Mus., Bull. 92, 1915, p. 968. (See for complete synonymy).

Meek's description of the species is as follows:

Shell small, ovate in outline. Larger valve about one-fifth longer than wide, with height one-third to one-fourth the breadth. Apex obtuse, near half way between the middle and the larger end. Anterior end narrowly rounded, posterior end somewhat more broadly rounded, or almost subtruncate. Surface ornamented by six or seven sub-imbricating marks of growth. Smaller valve unknown.

This species is fairly common at all the collecting localities near Toronto; only the larger valve is found. In our collections many of these shells have been labelled *Pholidops subtruncata* with which the present species is closely related. In our opinion, however, all the shells are to be referred to *P. cincinnatiensis*. Dimensions of form figured: length 5.7 mm., width 4.6 mm.

Locality— Don brickyards; Humber river, Toronto.
No. 1108 H.R. Royal Ontario Museum of Paleontology.

Family ORTHIDAE

Genus DALMANELLA, *Hall and Clarke.*

DALMANELLA, *Hall and Clarke.* Pal. New York, 8, pt. 1, 1892, pp. 205, 223.

The description of the genus is as follows:

Shells plano-convex or subequally biconvex. Pedicle valve usually the deeper, often gibbous, elevated at the umbo and arched over the cardinal area. Hinge line generally shorter than the greatest width of the shell. In many of the species there is a more or less conspicuous, undefined median fold and sinus on the pedicle and brachial valves respectively. Surface covered with fine, rounded bifurcating striae.

In the pedicle valve the teeth are quite prominent, thickened at their extremities and supported by lamellae which are produced forward circumscribing a rather short suboval or subquadrate muscular area, which is more or less distinctly defined in different species and in different conditions of the shell. In *Orthis meeki*, Miller, a somewhat ponderous, biconvex, multistriate variation of *Orthis testudinaria*, it is clearly resolvable into adductor and diductor scars, the latter bounding, but not altogether enclosing, the impression of the adductors; the pedicle-scar is also discernable. In the brachial valve the cardinal process extends forward as a ridge to the bases of the crural plates, where it is broadened and continued thence as a median ridge separating the muscular impressions. The inner surface of this process is divided by a faint median furrow which produces two lobes at the posterior extremity, and each of these lobes is again divided making the process quadrilobate. Sometimes the inner division of the two main lobes have coalesced, producing a strong median lobe and thus making the process appear trilobate. In some species at maturity, and in others from abnormal growth this process becomes a broad plug, which fills the entire delthyrial opening. The dental sockets are small, the crural plates often greatly elevated, especially in the plano-convex forms, and they are not usually produced into a ridge about the muscular area, but end abruptly. Muscular impressions quadruplicate, sometimes with radiating ridges extending from the lateral and anterior margins.

DALMANELLA RUGOSTRIATA, *sp. nov.*

Plate VII, Figures 9 and 10.

In our collections there is only one species referable to the genus *Dalmanella* this has commonly been regarded as *Dalmanella testudinaria* or a variety of that variable species. We are now convinced that it differs sufficiently from any known form to justify the creation of a new species.

The shell is known chiefly by a number of flattened pedicle valves preserved in shale. The generic reference and specific characteristics are founded, therefore on the external features of this valve only. The shell is transversely oval being somewhat wider than long and thus differing in outline from *D. testudinaria*. The cardinal angles are rounded and the posterior margin shows a slight concavity between the angle and the rather prominent beak. The surface presents about seventy-five radiating striae of which possibly ten actually reach the beak. These striae are rather irregular and arise partly by bifurcation and partly by intercalation. On the lateral slopes the striae arise with fair uniformity as follows: two main striae bifurcate and between the pairs thus produced a single stria is intercalated which is more closely associated with the posterior than with the anterior neighbouring stria. In consequence of this arrangement the striae appear roughly in groups of three.

A characteristic feature of the ornamentation is the presence in the depressions between the striae of delicate transverse markings very suggestive of those observed in *Dinorthis carleyi* (*Plaesiomys retrorsa*).

The average measurements of the co-types are: length 15 mm., width 21 mm. The largest shell from which the outline of the figure was drawn measures 22 by 17 mm.

Locality.—Don brickyards, Toronto.
No. 1078 H.R. Royal Ontario Museum of Paleontology.

Family STROPHOMENIDAE

Genus LEPTAENA, *Dalman*

LEPTAENA, *Dalman*. Kongl. Svenska. -Akad. Handl., for 1827, 1828, pp. 93, 94.
LEPTAENA, *Hall and Clarke*. Pal. New York, 8, pt. 1, 1892, p. 276.
LEPTAENA, *Bassler*. U.S. Nat. Mus., Bull. 92, 1915, p. 708. (*See* for full synonymy).

The description given by Hall and Clarke is too long to quote in full. The following quotations, however, give a fairly full account of the genus:

Shells plano-convex when young, concavo-convex at maturity; convexity normal. Surface covered by conspicuous concentric corrugations or wrinkles over the flatter portions of the valves. Where these cease the surface is more or less abruptly and often rectangularly deflected, forming a conspicuous anterior slope. The whole exterior is covered with fine, even, radiating, thread-like tubular striae, which in well preserved specimens, are crenulated by finer concentric striae. Outline transversely subquadrate or semi-oval. Hinge-line straight, its length making the greatest diameter of the shell; extremities often subauriculate. Cardinal area narrow, slightly wider on the pedicle valve, not denticulate. In the pedicle valve, the delthyrium is covered by a convex deltidium, perforated at the apex by a foramen which is closed at maturity or encroaches upon the apex of the valve. This deltidium is most conspicuously developed in early stages of growth, then having the form of a tube or sheath, which character becomes obliterated as maturity approaches, by the increase in the size of the cardinal process of the opposite valve, and the callosities formed about its base. In adult shells the foramen has become enclosed by the substance of the shell, its external opening being an oblique groove in front of the apex of the valve, and its inner aperture appearing in front of the pedicle scar. Not infrequently the passage is closed at maturity.

LEPTAENA RHOMBOIDALIS (*Wilckens*)

Plate VII, Figure 12.

CONCHITA RHOMBOIDALIS, *Wilckens*. Nachricht von selten Versteinerungen, 1769, p. 77, pl. 8, figs. 43, 44.
STROPHOMENA DEPRESSA, *Billings*. Can. Nat. & Geol. 1, 1856, p. 59, pl. 1, fig. 5.
LEPTAENA DEPRESSA, *Hall*. Pal. New York, 2, 1852, p. 62, pl. 21, fig. 8, p. 257, pl. 53, fig. 6.
STROPHOMENA RHOMBOIDALIS, *Billings*. Can. Jour., 6, 1861, p. 336, figs. 111, 112.
STROPHOMENA RHOMBOIDALIS, *Chapman*. Expos. Min. Geol. Canada, 1864, p. 115, fig. 6; p.193, fig. 232.
LEPTAENA RHOMBOIDALIS, *Hall and Clarke*. Pal. New York, 8, pt. 1, 1892, p. 279, pl. 8, figs. 17-31, pl. 15a, figs. 40-42, pl. 20, figs. 21-24.
LEPTAENA RHOMBOIDALIS, *Cumings*. 32nd Ann. Rep. Dept. Geol. Nat. Res. Indianna, 1908, p. 909, pl. 34, figs. 5-5d.

Hall's description is as follows:

Shell semioval or semicircular; hinge-line equal to, or extending beyond, the width of the shell; dorsal valve having the upper part nearly flat, slightly convex or even concave, with strong concentric undulations towards the margin abruptly inflected; ventral valve parallel to the dorsal valve, presenting a deep concavity. Surface marked by prominent radiating striae.

The cardinal area is narrow, and extended to the extremities of the hinge-line; the foramen is broad and spreading, but filled by a callosity of the ventral valve, which has a narrow groove at its summit for the protrusion of the pedicle; the apex of the dorsal valve is often, and perhaps always, perforated. [1]

The flatter portions of both valves are strongly marked by concentric undulations, which are crossed by finer striae. On the deflected portion there are no undulations, the striae alone marking the surface. Sometimes the shell is nearly flat, the deflected portion being either very narrow, or not at all conspicuous. The undulations are variable in number, even in shells of the same size, and not to be relied upon as characteristics; and in very old shells they are not so strong as in younger ones, or those of medium size. The striae crossing the undulations are likewise variously prominent in different individuals, frequently bifurcating, and in well-preserved surfaces are crossed by fine concentric striae. The interior structure is always peculiar and sufficiently characteristic, though the exterior characters are very closely simulated by a different shell in the shaly limestone of the Helderberg.

This species is of fairly common occurrence at Toronto but usually only the dorsal valves are found. The undulations are comparatively low and variable, usually numbering from 13 to 15. The anterior margin is less strongly inflected than in specimens of this species from other localities and horizons. Our examples seem to conform most closely to those from the lower rocks of the type locality which are smaller, less strongly inflected, and with fewer undulations than those from the higher strata.

While this species is so well marked that its identification is comparatively easy, detailed study of recent years has led to the recognition of a number of varieties. Foerste is inclined to regard the specimens from the Don as near, if not identical with, his variety *L. rhomboidalis invenusta*. The specimen used for the figure which is a fairly large example is 23.3 mm. across the hinge-line, 14.2 mm. in maximum length.

Locality.—Don brickyard, Toronto.

Nos. 1109 H.R. and 1110 H.R. Royal Ontario Museum of Paleontology.

Genus Plectambonites, *Pander*

Plectambonites, *Pander*. Beitrage zur Geognosie des Russ. Reiches, 1830, p. 30, pl.3, figs. 8, 16; pl. 28, fig. 19.

Plectambonites, *Hall and Clarke*. Pal. New York, pt. 1, 1892, pp. 236, 295.

The genus is thus defined by Hall and Clarke:

Shells usually small, normally concavo-convex. Surface covered with very fine striae, often alternating in size. Hinge line making the greatest width of the shell, the extremities often subauriculate. Cardinal area narrow in both valves, sometimes obscurely crenulated on the margins. Pedicle valve with a moderately broad delthyrium which is partially closed by a convex plate, but mostly occupied by the cardinal process of the opposite valve. Apical foramen sometimes retained. Teeth prominent and supported by thickened plates, which are continued in broad outward curves for more than half the length of the valve, returning and uniting in the umbonal cavity, thus limiting two linguiform muscular scars, enclosing a more or less clearly defined adductor impression.

In the brachial valve, the dental sockets are deep, and often appear to transect the cardinal area. The cardinal process is simple and erect but by its coalescence with the short prominent crural plates, the posterior face appears trilobate. The crural plates end abruptly as in *Orthothetes* becoming thickened at about the middle of their length giving origin to two low ridges or septa, which at first approach each other, and thence continue forward with a slight divergence, thus forming the inner boundaries for two elongate muscular scars, which are less sharply defined on their outer margins. The muscular area is rendered quadripartite by two short transverse or oblique posterior furrows. Vascular impressions radial, sometimes digitate. Shell substance fibrous, sparsely punctate.

[1] Hall's use of the terms "dorsal" and "ventral" is the reverse of the modern.

Plectambonites sericeus (*Sowerby*)

Plate VII, Figures 15 and 16.

Leptaena sericea, *Sowerby*. Murchison's Sil. Sys., 1839, pl. 19, figs. 1, 2.
Leptaena sericea, *Hall*. Pal. New York, 1, 1847, pp. 119, 287, pl. 31b, fig. 2; pl. 79, fig. 3.
Leptaena sericea, *Billings*. Geol. Can., 1863, p. 163, fig. 139.
Strophomena sericea, *Emmons*. Amer. Geol. 1, pt. 2, 1855, p. 199, pl. 2, fig. 6 a-f.
Strophomena semiovalis, *Vanuxem*. Geol. New York, Rep. 3rd Dist., 1942, p. 37.
Plectambonites sericea, *Shaler*. Mem. Surv. Kentucky, 1, 1876, p. 28.
Plectambonites sericeus, *Cumings*. 32nd Ann. Rep. Dept. Geol. Nat. Res. Indiana, 1908, p. 922, pl. 36, figs. 1-1c.
Plectambonites sericeus, *Bassler*. U.S. Nat. Mus., Bull. 92, 1915, p. 997. (See for more complete synonymy).

Sowerby's original description follows:

Semicircular; finely striated longitudinally, with a silky lustre; a few striae deeper than the others; larger valve convex, the other nearly flat; front not concave, considerably deflected at the edge. Length five lines, width ten lines.

In general form this resembles *L. lata* of the Ludlow rocks, but has much finer striae and more angular sides. The front also is straighter, and there are no indications of spines. Sometimes a few concentric lines of growth are conspicuous.

Plectambonites sericeus, originally described from Europe, occurs in North America in strata from the Trenton to the Richmond, sometimes in enormous numbers. At Toronto it is exceedingly common in the upper layers at the Don brickyard; is rare or absent in the lower layers on the Humber; but recurs, perhaps with a varietal difference, in the highest layers at Weston.

The elongate shape of the shell and its silky, fibrous structure when broken serve best for its identification. Young specimens are much less elongate, however, and care must be taken in this respect. A species of such long range and wide distribution naturally shows minor variations such as varying size, the degree of prolongation of the cardinal angles, and more or less departure from the semicircular form by a straightening of the anterior margin. All our specimens are fairly constant in form and agree with the example figured which is of average size—22 mm. wide and 8.5 mm. long. It will be observed that the length is less than half the width.

Locality.—Don brickyard, Toronto.
No. 1109 H.R. Royal Ontario Museum of Paleontology.

Plectambonites *cf.* rugosus (*Meek*)

Plate VII, Figure 11.

Leptaena rugosa, *James*. Cat. Foss. Cincinnati Group, 1871.
Leptaena sericea *var* rugosa, *Meek*. Pal. Ohio, 1, pt. 2, 1873, pl. 5, figs. 3f, g, h.
Plectambonites rugosa, *Foerste*. Bull. Sci. Lab. Denison Univ., 17, 1912, p. 123, pl.1, figs. 7a-c; pl. 10, figs. 7a-d.
Leptaena aspera, *James*. Cincinnati Quart. Jour. Sci., 1, 1874, p. 151.
Plectambonites sericeus *var.* asper. *Ruedemann*. Bull. New York State Museum, 49, 1901, p. 18, pl. 1, figs. 6, 7; ibid., 8, p. 525.

James described as *Leptaena rugosa* a species of *Plectambonites* which seems to differ from *P. sericeus* in two features which have been considered in some detail by Foerste (*op. cit.*). One of these characteristics is the presence of a number of oblique crenulations along the cardinal margin of both valves. Similar crenulations occur in many other brachiopods which are normally without them and may, therefore, be of no specific value. The other determinative feature of *Leptaena rugosa* is "the roughened surface of the general exterior surface of the valves, especially anteriorly. This roughened surface appears due to the presence of numerous very thin overlapping films of shell material." The name *rugosa* refers to the latter characteristic and not to the presence of the crenul-

ations. Meek, however, refers only to the crenulations in the text accompanying his figures. Ruedemann, also, seems to regard the crenulations and the somewhat straighter anterior margin as characteristic.

Accompanying normal examples of *Plectambonites sericeus* in the rocks at Toronto and Weston are a number of closely related forms differing in the possession of oblique corrugations along the hinge line which may be but faintly developed or which may be quite marked. Smaller forms do not differ markedly in outline from normal examples of *Plectambonites sericeus* and even some of larger size are essentially similar in shape. Extreme types, however, with well developed corrugations are decidedly more mucronate and apparently with a slight sinuous indentation of the anterior margin. The specimen figured is one of the most extreme encountered. In no case was any evidence observed of the rugose characteristic, *i.e.*, of the roughening of the exterior by thin overlapping films of shell-matter.

These shells are undoubtedly close to *Plectambonites rugosus* which is recognized by authorities as a distinct species; we feel compelled, therefore, to place our specimens under that species. Nevertheless, lacking any evidence of the "rugose" characteristic, and observing transitions in the crenulations from the extreme types to normal *P. sericeus*, it might be more advisable to adopt the views of Meek and of Ruedemann leaving these crenulated forms under *P. sericeus* with a varietal distinction *rugosus*.

Locality.—Don brickyard, Toronto.
No. 1111 H.R. Royal Ontario Museum of Paleontology.

Genus Rafinesquina, *Hall and Clarke*

Rafinesquina, *Hall and Clarke*. Pal. New York, 8, pt. 1, 1892, p. 281.
Rafinesquina, *Bassler*. U.S. Nat. Mus., Bull. 92, 1915, p. 1084. (See for full synonymy).

The original description of this genus is as follows:

Shells normally concavo-convex. Surface ornamented by radiating striae, of alternating size, crossed and crenulated by finer concentric striae. Cardinal margins without denticulations. Interior of the pedicle valve with the muscular area not strongly limited; consisting of two broad flabellate diductor scars enclosing an elongate, more distinctly defined adductor. The faintness of the limitation of this area is in marked contrast to the sharply defined muscular area in the corresponding valve of *Leptaena*. In the brachial valve the cardinal process is more closely sessile than in *Leptaena*, and there is frequently a linear callosity between the branches. The posterior adductor scars have the aborescent markings of *Leptaena rhomboidalis*, and these impressions are the only ones well defined, the anterior scars being narrow and rarely retained with distinctness. From the anterior margin of the muscular area radiate a series of irregular furrows and nodose ridges, which are to some extent of vascular origin.

Rafinesquina alternata (*Emmons*)

Plate VII, Figure 18.

Strophomena alternata, *Emmons*. Geol. New York, Rep. 2nd Dist., 1842, p. 395, fig. 3.
Leptaena alternata, *Hall*. Pal. New York, 1, 1847, pp. 102, 286, pl. 31, fig. 1; pl. 31A, fig. 1; pl. 79, fig. 2.
Rafinesquina alternata, *Hall and Clarke*. Pal. New York, 8, pt. 1, 1892, p. 282, pl. 8, figs. 6-11, 27, 28; pt. 2, 1895, pl. 84, figs. 17, 18.
Rafinesquina alternata, *Bassler*. U.S. Nat. Mus., Bull 92, 1915, p. 1085. (*See* for the very lengthy synonymy).

The description of this species given by Hall is as follows:

Broadly semioval; length and breadth about as 12 to 15; hinge line, in perfect specimens, a little longer than the width of the shell, slightly reflected at the extremities, which sometimes become short acute ears; cardinal area narrow, the callosity of the

ventral valve nearly filling the triangular foramen of the dorsal valve; beak uniformly perforated with a minute circular opening; dorsal valve depressed convex, sometimes more convex in the middle, suddenly deflected near the margin and flattened towards the cardinal line; ventral valve concave, gradually or sometimes suddenly inflected towards the basal margin; surface marked by fine rounded radiating striae, which alternate at unequal intervals with coarser ones; striae increasing in number towards the margin of the shell, crossed by fine elevated concentric lines and a few imbricating lines of growth.

In this species the striae are usually of two sizes, the coarser and more elevated ones having from four to six finer ones between; the latter increase in number as they recede from the apex, and one of them, in the centre of the fascicle, becomes enlarged and rises above the others. Some of the specimens figured are strongly marked individuals, where these characters are very distinctly preserved; but there are many variations from the type of the species, and some others where it is difficult to decide their true relations when we have not a series showing their gradations.

The characteristic developments of the shell depend on the circumstances of its existence and the nature of the sediments. There are other differences which are due to causes beyond our knowledge; for, in the same locality, and where great numbers of them must have lived under precisely similar circumstances, we find considerable variation in character. In the compact limestones of New York, where, in splitting the rock, a portion of the shale often exfoliates, we find a great deviation from the type of the species. The age of the shell also exerts considerable influence upon its external form. The young ones, or those of medium size, are usully symmetrical shells, moderately convex, and gently curving towards the base. The striae in such individuals are distinctly in fascicles of from four to six, separated by stronger and more elevated single ones on either side; as the shell increases, this uniformity in the arrangement often disappears, and the striae appear of uniform size, or alternate irregularly. The concave or ventral valves, particularly in old specimens, have the striae nearly uniform in size.

From the above description it will be seen that we have to deal with a shell subject to much variation which has led to the founding of a number of varieties since the species was established. A careful comparison of our specimens with these varieties leads to the conclusion that the Toronto examples are nearest to the type, varying chiefly in the loss of distinct alternation of striae in older specimens and the development of a somewhat pustulose character along the line where the convex valve is deflected towards the anterior margin. The form figure has the following dimensions: width along hinge line, which is slightly less than the greatest width of the shell, 33.3 mm.; length, 29.2 mm.

Locality.—Humber river, Bloor Street crossing, Toronto.
No. 1112 H.R. Royal Ontario Museum of Paleontology.

Rafinesquina mucronata, *Foerste*.

Rafinesquina mucronata, *Foerste*. Bull. Sci. Lab. Denison Univ., 17, 1914, p. 365, pl. 2, figs. 7a, b.

Rafinesquina alternata, *Foerste*. Geol. Surv. Can. Mem. 83, 1916, p. 74.

Foerste described this species from types obtained on the Nicolet river, Quebec; he also records its occurence at Weston. The description follows:

Shell small, the length about three-fifths of the width, but varying in different individuals. Usually slightly extended along the hinge line beyond the middle width of the shell so as to produce a small mucronate projection; but some individuals have rectangular posterolateral outlines. Usually obliquely wrinkled along the hinge line. Radiating striae fine, with every fourth one distinctly more conspicuous along the middle and anterior parts of the valve; usually the stria found along the median line of the shell is more conspicuous than any of the remainder. Pedicle valve only moderately convex, the brachial valve slightly concave almost flat.

The species appears closely allied to *Rafinesquina squamula*, James, from the Fairmount beds in the lower part of the Maysville division of the Cincinnatian strata in Ohio. The latter, however, is not so characteristically mucronate at the ends of the hinge line, nor so characteristically obliquely wrinkled along the posterior margin.

Foerste (*op. cit.*) records this species from Weston, but we have not seen any specimens that can unhesitatingly be ascribed to it.

Rafinesquina mucronata torontonensis, *var. nov.*

Plate VII, Figures 13, 14, 17.

In many of the exposures along the Humber river there occur scattered examples of a small strophomenoid shell very closely resembling *Rafinesquina mucronata*. They occur in particular abundance in a narrow band of yellowish-grey shale, near the water level immediately below the road bridge at Lambton.

In general shape, mucronate character, and degree of convexity of the valves these shells agree with *Rafinesquina mucronata*. They differ, however, in that no trace of the oblique crenulations along the posterior margin was observed, and there is no evidence of every fourth stria being more conspicuous.

A striking feature of the shell is the strong development of the median stria which is most pronounced in younger specimens. The remaining striae are rounded and almost equal in strength. In the better preserved specimens from the arenaceous limestones the radiating striae are crossed by very delicate concentric lines. The absence of crenulations along the hinge line suggests that this form is more closely related to *R. squamula*, U. P. James, but that species is not characterized by a strongly developed middle stria. There is also a very close resemblance to *Leptaena* (*Rafinesquina*) *mesacosta*, Shumard: size, shape, character of radiating and concentric striae, strong median stria, and mucronate cardinal angles all agree very closely. The much higher horizon of *Leptaena mesacosta* (Silurian), however, seems to make the identity of the two species impossible.

Figures 13 and 14 represent the pedicle and brachial valve respectively of an average specimen from the shale bed near the Lambton bridge. Width, 14 mm., length 10 mm. Figure 17 represents a younger specimen from the old mill-race near the Humbervale quarry: it will be observed that the median stria is more conspicuous in this example.

Locality.—Mill-race, Humbervale quarry; water level below bridge at Lambton. Nos. 1113 H.R., 1114 H.R. Royal Ontario Museum of Paleontology.

Strophomena incurvata (*Shepard*)

Producta incurvata, *Shepard*. Amer. Jour. Sci., 34, 1838, p. 144, figs. 1, 2.
Leptaena filitexta, *Hall*. Pal. New York, 1, 1847, p. 111, pl. 31B, fig. 3.
Strophomena filitexta, *Billings*. Canadian Nat. Geol., 1, 1856, p. 203, figs. 1, 2.
Strophomena filitexta, *Nicholson*. Pal. Prov. Ontario, 1875, p. 34, figs. 10, a, b.
Strophomena incurvata, *Bassler*. U.S. Nat. Mus., Bull. 92, 1915, p. 1229, (See for complete synonymy).

Nicholson (*op. cit.*) states that this species is abundant in the Hudson River group at Weston, and Wood point, Georgian bay. We have not observed the form in our somewhat extensive collections from Weston and as it is a characteristic fossil of the Stones River and Black River formations, its occurrence at Weston is at least doubtful despite Nicholson's assertion.

In the genus *Strophomena* the valves are concave-convex in the opposite direction from that which maintains in *Rafinesquina*, i.e., the pedicle valve is concave and the brachial valve convex. The species, *S. incurvata* has a general resemblance to *Rafinesquina alternata* but it is distinguished by the uniformity of the radiating striae and the fine concentric striae are so conspicuous as to give the surface a woven appearance.

Order TELOTREMATA

Family RHYNCHONELLIDAE

Genus Rhynchotrema

Rhynchotrema increbescens (*Hall*)

Atrypa increbescens, *Hall*. Pal. New York, 1, 1847, pp. 146, 289, pl. 33, figs. 13 a-h; pl. 79, fig. 6.

Rhynchotrema increbescens, *Bassler*. U.S. Nat. Mus., Bull. 92, 1915, p. 1125, (*See* for full synonymy).

In the "Geology of Canada, 1863", page 213 this species is recorded as occurring on the Humber river. We have been unable to identify it: the form referred to is probably *Zygospira cincinnatiensis*.

Family ATRYPIDAE

Genus Zygospira, *Hall*

Stenochisma, *Hall* (non Conrad). Pal. New York, 1, 1847, p. 142.
Stenochisma, *Meek and Hayden*. Pal. Upper Missouri, Smith. Con. to Knowl., 14, 1864, p. 16.
Zygospira, *Hall*. 15th Rep. New York State Cab. Nat. Hist., 1862, p. 154, figs. 1-2.
Zygospira, *Hall and Clarke*. Pal. New York, 8, pt. 2, 1894, p. 154.
Anazyga, *Davidson*. Brit. Sil. Brach., Sup., Pal. Soc., 1882, p. 128.
Hallina, *Winchell and Schuchert*. Prel. Desc. Am. Geol., 9, 1892, pp. 291-292.
Protozyga, *Hall and Clarke*. Pal. New York, 8, pt. 2, 1894, p. 151.
Orthonomaea, *Hall and Clarke*. 47th Rep. New York State Mus., 1894, p. 1008.

Hall and Clarke's description of this genus is as follows:

Shells usually small. Outline subcircular or transversely oval. Contour subplano-convex. Surface sharply plicate. Pedicle valve with a median plicated ridge. Umbo narrow and prominent: deep acute and incurved. Foramen elongate, rarely apical, enclosed by the deltidial plates. Hinge line long and straight; cardinal extremities rounded. A distinct false area is formed by a pair of ridges diverging from the beak toward the cardinal extremities. On the interior the teeth are moderatelyt well developed and unsupported by dental lamellae.

The brachial valve is depressed convex in the umbonal region and bears a more or less conspicuous median sinus. The hinge plate consists of two broad, stout processes, diverging outwardly, grooved on their summits, and separated from each other by a narrow, sharp crest. They form both the socket walls and crural bases, and are supported by a low median ridge. Muscular impressions obscure in the typical species.

The crura are short and straight at their union with the primary lamellae, making a rectangular curve. The first half-volution of the ribbon lies just within the margin of the valve, and the number of volutions is small. The spirals have their bases parallel to the lateral slopes of the pedicle valve and their apices directed obliquely toward the centre of the opposite valve. The loop is a continuous band, variable in position and shape. It may originate on the posterior or anterior limb of the primary lamellae, or be placed medially; its apex is always angular and directed anteriorly and the lateral curves vary in length and degree according to their position with reference to the spirals.

The rocks at Toronto contain great numbers of small shells referable to the genus Zygospira. The largest of these is *Zygospira erratica*. Most of the smaller shells are so badly crushed that specific determination can not be made with great certainty. They fall, however, into two groups characterized, in the crushed condition, only by a greater or less number of plications. The better preserved shells show additional features by which they may be distinguished. We are of the opinion that the form with fewer plications may be ascribed to *Zygospira cincinnatiensis*, Meek, and that the type with more numerous plications is *Zygospira modesta*, Hall.

Zygospira modesta, *Hall*

Plate VII, Figures 19 and 22.

Atrypa modesta (*Say*) *Hall*. Pal. New York, 1, 1847, p. 141, pl. 15, fig. 15.
Zygospira modesta, (*Say*) *Hall*. 15th Rep. New York State Cab. Nat. Hist., 1862, p. 154.
Rhynchonella modesta, *Billings*. Geol. Surv. Canada, Rep. 1863, p. 211, fig. 211.
Zygospira modesta, *Meek*. Pal. Ohio, 1, 1873, p. 125, pl. 11, fig. 4.
Zygospira modesta, *Foerste*. Bull. Sci. Lab. Denison Univ., 16, 1910, p. 29, pl. 2, figs. 15a-b.
Zygospira modesta, *Foerste*. Geol. Surv. Canada. Mem. 83, 1916, pp. 22, 23.
Zygospira modesta, *Bassler*. U.S. Nat. Mus., Bull. 92, 1915, p. 1341. (See for full bibliography).

Meek's description (*op. cit.*) is as follows:

Shell small rather depressed, nearly plano-convex, sub-orbicular, or sometimes a little wider than long; posterior lateral margins straightened and converging to the beaks at an obtuse angle; lateral margins more or less rounded, or sometimes a little straightened, or very slightly sinuous at the middle.

Dorsal valve, with a rather shallow, undefined mesial sinus of moderate breadth at the front, but becoming rapidly narrower, and less impressed posteriorly, so as often to die out before reaching the umbo; surface on each side of the sinus gently convex centrally, and gradually sloping to the lateral margins; beak but slightly prominent and incurved.

Ventral valve, with a low mesial ridge, corresponding to the sinus of the other valve, excepting that it is generally most prominent near the middle, and somewhat depressed anteriorly; while on each side of the ridge the slopes are distinctly compressed; beak small, abruptly pointed, projecting beyond that of the other valve, and rather distinctly arched; but not so closely incurved as to conceal the small fissure, which seems to be closed below by a deltidium, that leaves a minute aperture above, just under, or extending to the apex; margin on each side of the beak carinated, so as to give the appearance of a kind of false cardinal area.

Surface of each valve ornamented by about 16 to 18 small, simple radiating plications, of which about three to five near the front of the dorsal valve occupy the mesial sinus, the middle one being usually a little the largest; while on the ventral valve about four of the largest occupy the mesial prominence, the furrow between the middle two being generally a little larger and deeper than the others; marks of growth undefined, or extremely minute and obscure.

Length of mature, moderately large specimen, 0.26 inch; breadth, 0.30 inch; convexity, 0.15 inch.

Foerste (*op. cit.*) redescribes the species and gives the additional information that the type specimen is 7.8 mm. long, 9.2 mm. wide, and 4.1 mm. thick. He also states that the characteristic features are the low median fold and the rather numerous lateral plications, all of them primary. In the type specimen there are seven of these plications on each side, but the number is frequently eight and sometimes nine. The pedicle valve of the type has eighteen distinct plications and two faint ones near the hinge line. Certain specimens attain a length of 10 mm.

In the Toronto rocks, this species is of less frequent occurrence than *Zygospira cincinnatiensis* from which it may be distinguished, even in the flattened condition, by the fact that the brachial valve of the latter seldom shows more than thirteen plications which are of necessity broader and coarser in specimens of the same size.

The largest brachial valve observed is 16 mm. wide and shows twenty-one plications in all. The sinus is scarcely observable and there is some tendency towards bifurcation in the plications, a feature not generally admitted for *Z. modesta*. A typical brachial valve from Toronto is shown in Plate VII, Figure 22. Despite our large collections, a really good pedicle valve suitable for reproduction was not found; in consequence, a specimen from Manitowaning has been used to illustrate this valve.

The dimensions of the brachial valve are: length, 6 mm.; width, 7.8 mm. The sinus is shallow and inconspicuous and the anterior margin without sinuosity. There are nineteen distinct non-bifurcating plications of which the middle one is larger and more rounded.

Locality.—Don Valley brickyard, Toronto.
Manitowaning, Ontario.
Nos. 584 H.R., 600 H.R. Royal Ontario Museum of Paleontology.

Zygospira cincinnatiensis, *Meek*

Plate VII, Figures 20, 21, 23.

Zygospira cincinnatiensis, *James*. Cat. Fossils Cin. Group, 1890, p. 11.
Zygospira cincinnatiensis, *Meek*. Pal. Ohio, 1, 1873, p. 126, pl. 11, fig. 5.
Zygospira cincinnatiensis, *Hall and Clarke*. Pal. New York, 8, pt. 2, 1895, pl. 54, figs. 13, 14.
Zygospira cincinnatiensis, *Cumings*. 32nd Ann. Rep. Dept. Geol. Nat. Res. Indiana. 1908, p. 945, pl. 36, figs. 9a-b.
Zygospira Cincinnatiensis, *Foerste*. Bull. Sci. Lab. Denison Univ., 16, 1910, p. 30, pl. 6, figs. 16 a-b.

Meek's description of this species follows:

This variety or species differs from the last (*Z. modesta*), in its larger size, greater proportional breadth, more prominent mesial elevation, with a larger and deeper sulcus along its middle, and in the deeper mesial sinus of its dorsal valve, and the more spreading character of its lateral plications. Its plications likewise differ in being proportionally coarser, and more angular, and more frequently show a disposition to bifurcate, particularly those on the sides of the mesial elevation of the ventral valve, and within or near the mesial sinus of the dorsal valve. Its lateral margins are likewise generally more compressed; and the beak of its ventral valve more strongly incurved.

Under a strong magnifier, in a favorable light, extremely minute, regular, and closely crowded concentric striae may sometimes be seen on the sides of the plications, and other protected parts of the shell. These are similar to those sometimes seen on the last, but more distinct.

Although this is possibly a distinct species from the last, it would, I should think, be rather difficult to distinguish young or small examples of it from that shell. Hence I am inclined to think that it may be only a robust variety of the same.

Length of one of the largest examples, 0.41 inch; breadth, 0.52 inch; convexity, 0.25 inch.

Later authors have been inclined to regard the species as distinct; for instance, Foerste (*op. cit.*) makes the following statement:

The specimens from the upper Fairmount, which are here regarded as typical, are distinguished from *Zygospira modesta* by the smaller number of primary lateral plications, usually five on each side of the median fold. In consequence, the plications appear larger, more angular, and more distant from each other. The more prominent median elevation on the pedicle valve is due chiefly to the larger size of the individuals. The four primary plications on the median fold and the intermediate grooves have very much the same appearance as in *Zygospira modesta*. While the birfucation of the primary plications, or the intercalation of additional ones, is the chief character usually relied upon in diagnosing this species, too much weight must not be given to this feature, since it is not constant, and numerous specimens may be collected at the typical horizon, in which there is no evidence of bifurcation. Among the four primary plications on the median fold, it is the lateral plications, and not the two median plications which frequently are bifurcated. Bifurcation of one or two of the lateral plications on each side of the median fold is not rare. Occasionally even the

two median plications on the fold are bifurcated towards the anterior margin of the shell, or one or two small plications are inserted near the anterior end of the median groove. Some of these specimens attain a length of 13 mm. Only the larger specimens are likely to show evidence of frequent bifurcation.

There is no doubt that our rocks contain a species of *Zygospira* which can be easily differentiated from *Z. modesta* by its fewer and more angular plications: there is little doubt that this form is *Z. cincinnatiensis* as defined by Meek and amended by Foerste. On the other hand, the form figured by Hall and Clarke (Plate 54, figs. 13 and 14 of work cited) does not agree with our interpretation of *Z. cincinnatiensis*.

The brachial valve (Plate VII, figs. 21 and 23) shows the characteristic broad sinus with a rounded median plication. On each side of this, within the sinus, is a much smaller and more angulated plication. The third, or sometimes the fourth, plication forms the edge of the sinus. The lateral plications are sharp, and more curved than in *Z. modesta;* they number four or five, making five or six lateral plications in all, counting the little one next to the median. In all, therefore, there are either 11 or 13 plications on this valve.

The pedicle valve (Plate VII, Fig. 20), owing to the greater prominence of the beak is less ovoid in shape than the brachial valve. The beak is rather pronounced, extended forward, and incurved. The fold, corresponding to the sinus of the other valve, extends well up on the beak: it is marked medially by a rounded groove. Bordering the groove is a small angular plication and outwards from this is a much larger plication marking the boundary of the fold. In addition are four, or sometimes five, lateral plications. Thus the complete valve generally shows 12 plications in all, but as many as fourteen may occur.

Bifurcation of the plications is frequently observed, particularly in the case of the large plication bounding the fold, and occasionally in the case of the lateral plications. The feature is of no specific value, however, as many specimens are devoid of bifurcation and others show it on one side but not on the other.

Zygospira cincinnatiensis is restricted, therefore, as far as the Toronto strata are concerned to those forms with not more than 15 plications on the brachial valve and 14 on the pedicle, and with clearly defined smaller plications on each side of the median line.

The brachial valve shown in figure 21 is one of the largest and most perfect found. The dimensions are: width, 9 mm.; length, 6.5 mm. The specimen shown in figure 23 has dimensions as follows: width, 5.8 mm.; length, 4 mm.

Locality.—Don Valley brickyard, Toronto.
Nos. 558 H.R., 601 H.R., 1115 H.R. Royal Ontario Museum of Paleontology.

Zygospira (?) erratica (*Hall*)

Plate VII, Figures 24, 25.

Orthis (?) erratica, *Hall*. Pal. New York, 1, 1847, p. 288, pl. 79, fig. 5.
Zygospira erratica, *Davidson*. Suppl. Brit. Sil. Brach., Pal. Soc., 1882, p. 126.
Catazyga erratica, *Hall and Clarke*. Pal. New York, 8, pt. 2, 1894, p. 158, pl. 54, figs. 17-23.
Orthonomaea erratica, *Hall and Clarke*. 47th Rep. New York State Mus. 1894, p. 1008.
Catazyga erratica, *Foerste*. Bull. Sci. Lab. Denison Univ., 17, 1914, p. 266.
Zygospira erratica, *Bassler*. U.S. Nat. Mus., Bull. 92, 1915, p. 1340.

This species has long been ascribed to the genus *Catazyga* but in the most recent revision—that of Bassler—it is placed, provisionally at least, under *Zygospira* in accord with the view of Davidson.

The definition of the species according to Davidson follows:

Shell marginally broadly rounded, or slightly broader than long, greatest breadth about the middle, hinge line rather long and nearly straight. Ventral valve convex longitudinally, somewhat carinated or flattened along the middle; beak incurved, beak-ridges sharply defined and leaving between them and the hinge line a narrow flattened space or false area. Dorsal valve convex at the sides, depressed longitudinally along the middle, and presenting a concave line in front. Surface marked by fine, unifirm, radiating, raised striae, increasing here and there in number by the interpolation of shorter and smaller ribs.

The genus *Catazyga* was founded on *Athyris headi*, Billings, as genotype; the shell is defined as being more convex than in *Zygospira*, with a low median sinus in both valves and much finer striations. The internal structure is much the same in the two genera.

The present species agrees with *Zygospira* in the form of the shell and with *Catazyga* in the character of the plications. In general appearance it is so close to *Catazyga headi* that the two species are often confused.

With the exception of *Pleclambonites sericeus* this is the commonest brachiopod found near Toronto. Most of the limey layers in the western part of the district, on the Humber, Etobicoke, and Mimico rivers, are crowded with shells of *Zygospira erratica*.

Locality.—Humber river, Toronto.

No. 1116 H.R. Royal Ontario Museum of Paleontology.

Since this article was prepared we have found a single crushed example of an ovoid, phosphatic shell which is certainly distinct from any other in our collection. It somewhat resembles *Trematis fragilis*, Ulrich, but fine concentric markings are more prominent than radiating lines of punctae. The form is very like an undescribed species of *Acrothele* figured by Reed from the Ordovician rocks of the Girvan district. No. 1238 H. R. Don valley.

Conclusion

A remarkable feature of the brachiopod fauna at Toronto is the relatively small number of species and the strongly eastern aspect of the assemblage. The abundance of *Pleclambonites sericeus* on the Don river, its probable total absence in the lower strata of the Humber, and its recurrence at Weston are facts of stratigraphic importance.

In this article no attempt has been made to indicate the vertical extent of any of the species described: that aspect of the subject is reserved for the section dealing with the stratigraphy. The localities given after each species are those from which the specimens used in the description were obtained.

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Explanation of Plate I.

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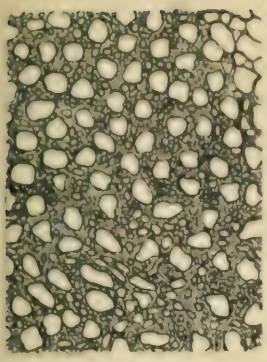
Fig. 5. *Peronopora vera*. Vertical section × 10 7
Fig. 6. *Prasopora donensis*. Vertical section × 10 7
Fig 7. *Prasopora donensis*. Tangential section × 10 7
Fig. 8. *Aspidopora* cf. *arcolata*. Tangential section × 10 4
Fig. 9. *Dekayella ulrichi*. Tangential section × 50, after Nicholson 9
Fig. 10. *Atactopora maculata*. Tangential section × 50 8
Fig. 11. *Dekayella ulrichi*. Vertical section × 18, after Nicholson 9
Fig. 12. *Leptotrypa expansa*. Tangential section × 25 10
Fig. 13. *Stigmatella vulgaris*. Tangential section near surface × 40 15
Fig. 14. *Stigmatella vulgaris*. Deep tangential section × 40 15

Plate I



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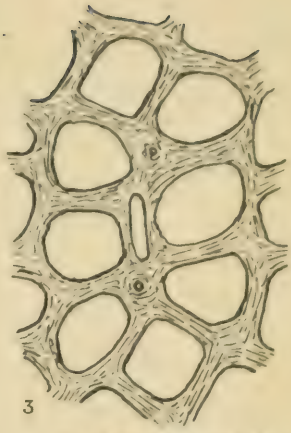

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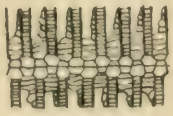

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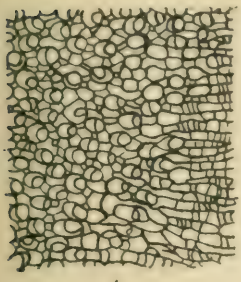

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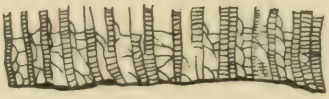

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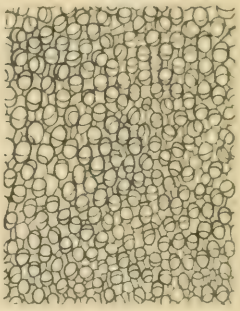

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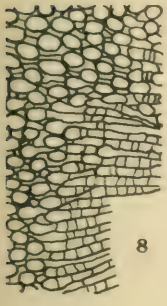

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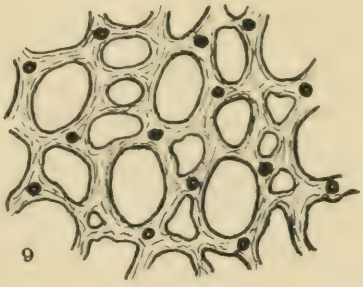

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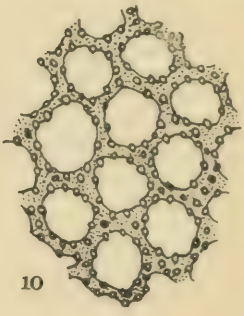

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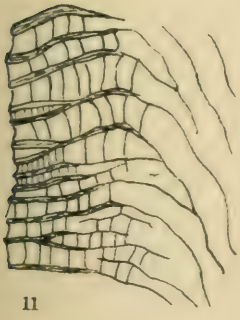

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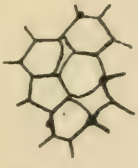

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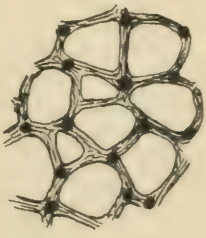

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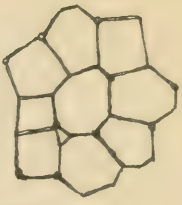

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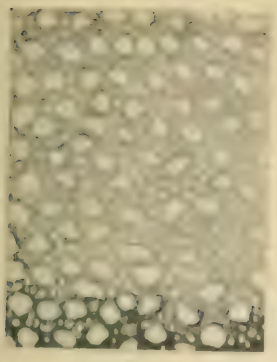
Explanation of Plate II.

Unless otherwise stated, figures are magnified ten diameters.

Page

Fig. 1. *Chiloporella flabellata.* Tangential section 2
Fig. 2. *Chiloporella flabellata.* Vertical section 2
Fig. 3. *Leptotrypa expansa.* Tangential section 10
Fig. 4. *Peronopora vera.* Tangential section 7
Fig. 5. *Peronopora vera.* Vertical section 7
Fig. 6. *Prasopora donensis.* Vertical section 7
Fig. 7. *Prasopora donensis.* Tangential section 7
Fig. 8. *Aspidopora cf. areolata.* Tangential section 4
Fig. 9. *Atactopora maculata.* Vertical section 8
Fig. 10. *Atactopora maculata.* Tangential section 8
Fig. 11. *Arthropora shafferi.* Surface × 18, modified from Ulrich, showing opercula 23
Fig. 12. *Bythopora arctipora.* Vertical section, imperfect 17
Fig. 13. *Stigmatella lambtonensis.* Vertical section 14

Plate II



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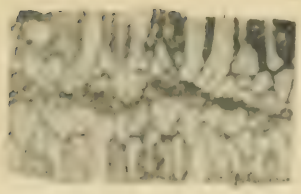

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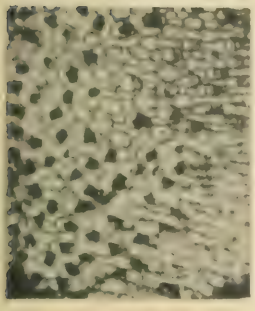

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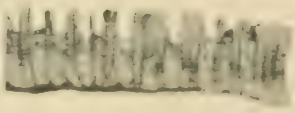

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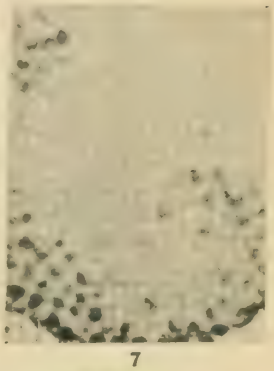

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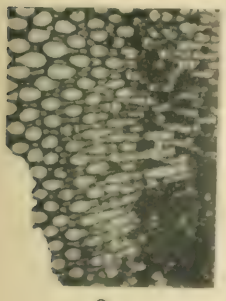

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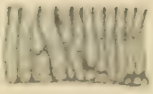

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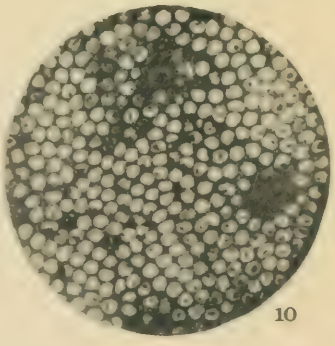

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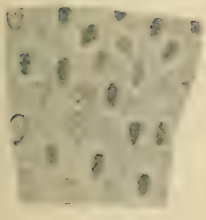

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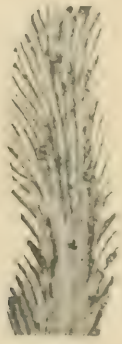

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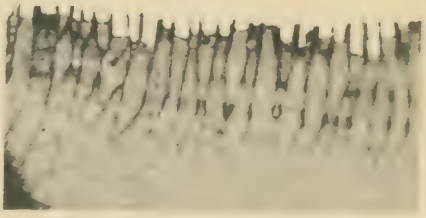


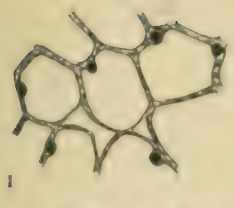
13

Explanation of Plate III.

Page

Fig. 1. *Stigmatella catenulata* (*var. a*) Tangential section × 50 12
Fig. 1a. *Stigmatella catenulata.* Tangential section of ordinary tissue × 45, after Cumings 12
Fig. 2. *Stigmatella catenulata* (*var. a.*) Vertical section × 10 12
Fig. 3. *Stigmatella catenulata* (*var. b.*) Tangential section × 10 12
Fig. 4. *Stigmatella crenulata.* Vertical section × 10 12
Fig. 5. *Stigmatella crenulata.* Tangential section × 10 12
Fig. 6. *Stigmatella personata.* Vertical section × 10 16
Fig. 7. *Stigmatella crenulata.* Tangential section after Ulrich and Bassler, showing groups of smaller cells, × 40 12
Fig. 8. *Stigmatella catenulata diversa.* Tangential section showing large and small cells × 40 14
Fig. 8a. *Stigmatella catenulata diversa* Tangential section showing average cells × 40 14
Fig. 9. *Hallopora dalei subalta.* Tangential section × 10 21
Fig. 10. *Paleschara beani.* Diagram showing manner of growth, × about 8 24
Fig. 10a. *Paleschara beani.* Surface × 10, after James 24
Fig. 11. *Hallopora dalei subalta.* Vertical section × 10 21
Fig. 12. *Hallopora* cf. *suplana.* Vertical section × 10 19
Fig. 13. *Hallopora* cf. *subplana.* Tangential section × 10 19

Plate III



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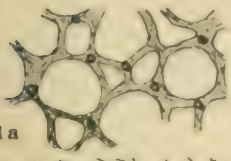

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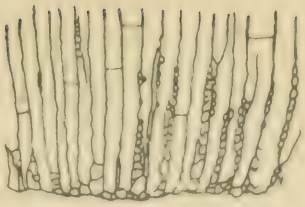

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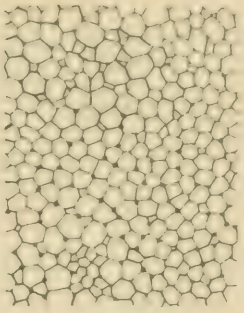

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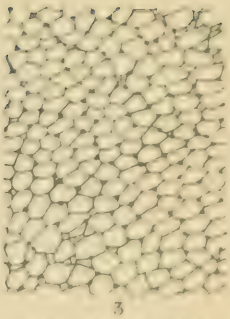

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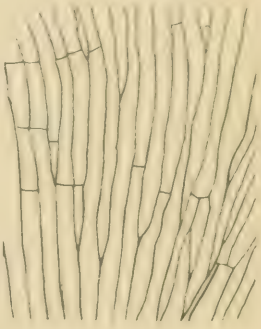

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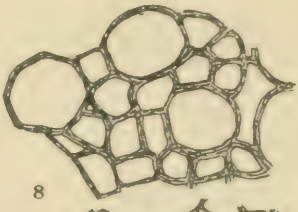

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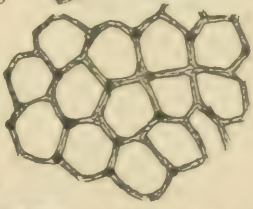

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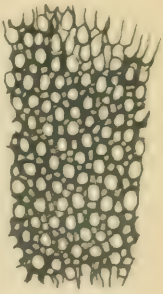

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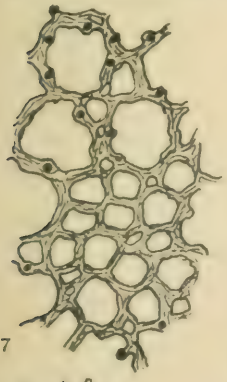

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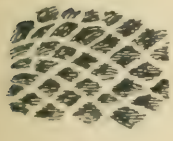

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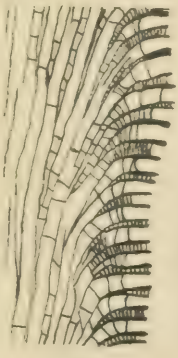

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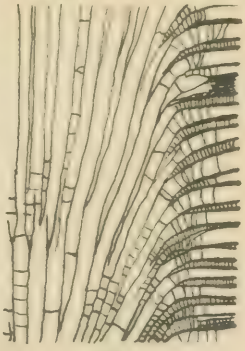

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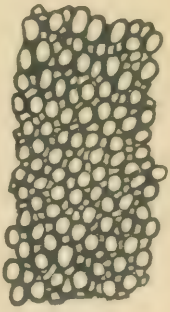


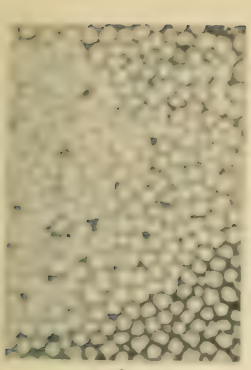
13

Explanation of Plate IV.

All figures × 10 Fig. 10 which is × 50.

Fig. 1. *Stigmatella catenulata (var. a.)* Tangential section 12
Fig. 2. *Stigmatella catenulata (var. a.)* Vertical section 12
Fig. 3. *Stigmatella catenulata (var. b.)* Tangential section 12
Fig. 4. *Stigmatella crenulata.* Vertical section 12
Fig. 5. *Stigmatella crenulata.* Tangential section 12
Fig. 6. *Stigmatella* cf. *personata.* Vertical section 16
Fig. 7. *Stigmatella* cf. *personata.* Tangential section 16
Fig. 8. *Hallopora dalei var. subalta.* Tangential section 21
Fig. 9. *Hallopora* cf. *subplana.* Transverse section 19
Fig. 10. *Hallopora dalei subalta.* Tangential section × 50 21
Fig. 11. *Hallopora dalei subalta.* Transverse section 21
Fig. 12. *Hallopora dalei subalta.* Vertical section 21
Fig. 13. *Hallopora* cf. *subplana.* Vertical section 19
Fig. 14. *Hallopora* cf. *subplana.* Tangential section 19

Plate IV



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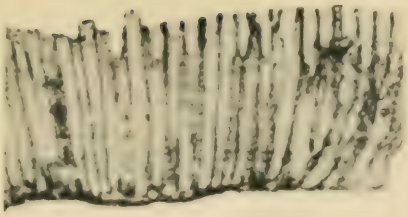

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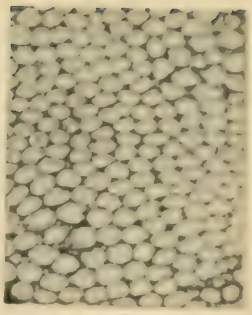

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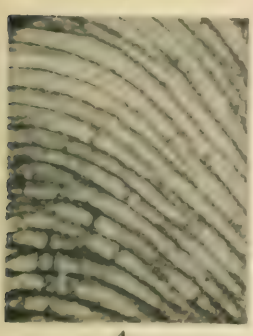

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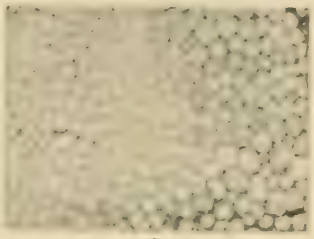

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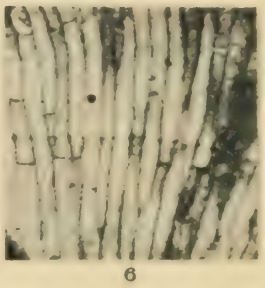

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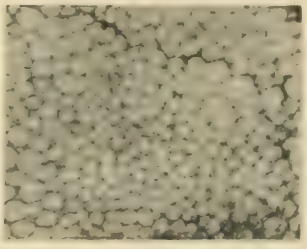

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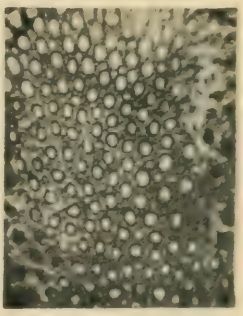

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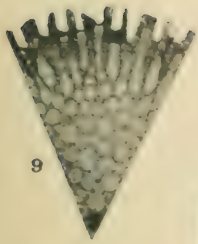

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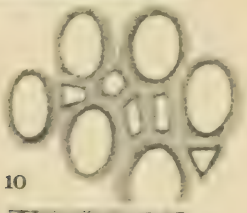

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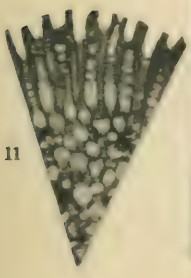

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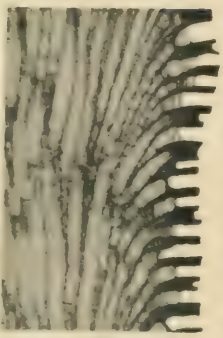

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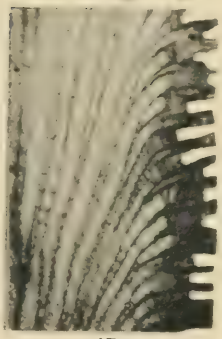

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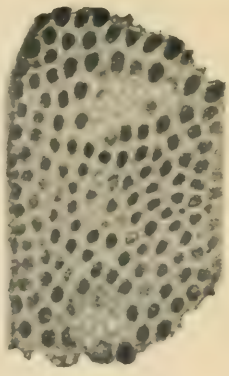

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Explanation of Plate V.

All figures are photographs of surfaces enlarged ten times.

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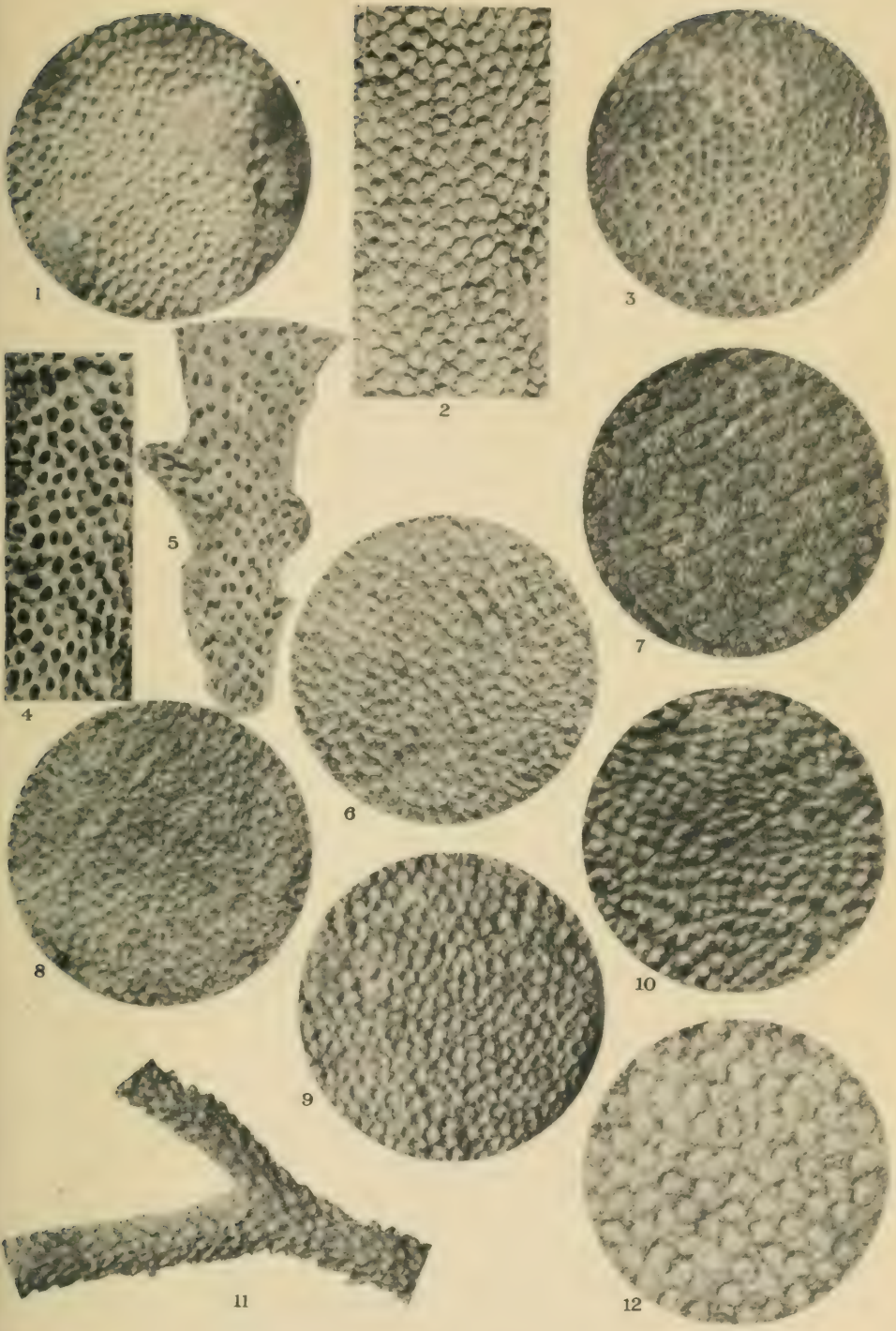
Fig. 1. *Atactopora maculata* .....
Fig. 2. *Hallopora dalei* var. *subalta.* .....
Fig. 3. *Peronopora vera* .....
Fig. 4. *Hallopora* cf. *subplana* .....
Fig. 5. *Arthropora shafferi* .....
Fig. 6. *Prasopora donensis* .....
Fig. 7. *Paleschara beani* .....
Fig. 8. *Stigmatella* .....
Fig. 9. *Dekayella ulrichi,* Vevay, Indiana .....
Fig. 10. *Spatiopora varians* .....
Fig. 11. *Bythopora arctipora* .....
Fig. 12. *Chiloporella flabellata* .....

Plate V

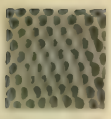


Explanation of Plate VI.

Page

Fig. 1. *Trematis millepunctata.* Portion of surface × 10 3
Fig. 2. *Prasopora donensis.* Complete zoarium, nat. size .....
Fig. 3. *Bythopora arctipora.* Fragments of zoaria, nat. size. 1
Fig. 4. *Bythopora* cf. *delicatula.* Portion of zoarium, nat. size. 1
Fig. 5. *Hallopora dalei subalta.* Surface between monticules × 7 2
Fig. 6. " " " Fragments of zoaria, nat. size 2
Fig. 7. *Aspidopora* cf. *areolata.* Surface. × 7 .....
Fig. 8. *Aspidopora* cf. *areolata.* Complete zoarium, nat. size .....
Fig. 9. *Hallopora* cf. *subplana.* Fragments of zoaria, nat. size 1
Fig. 10. *Atactopora maculata.* Fragment of zoarium, nat. size. .....
Fig. 11. *Ohiloporella* ?*abellata.* Lower portion of fan-like zoarium, nat. size. ....
Fig. 12. *Stigmatella vulgaris.* Almost complete zoarium, nat. size. 1

Plate VI



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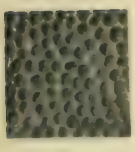

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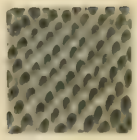

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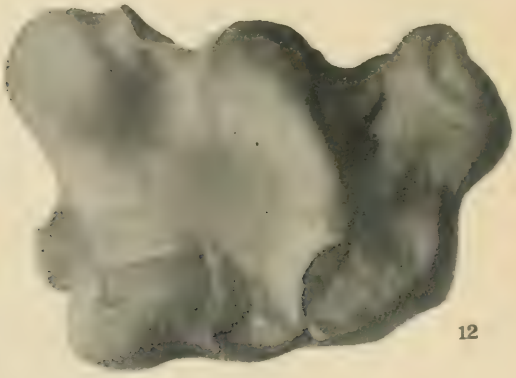

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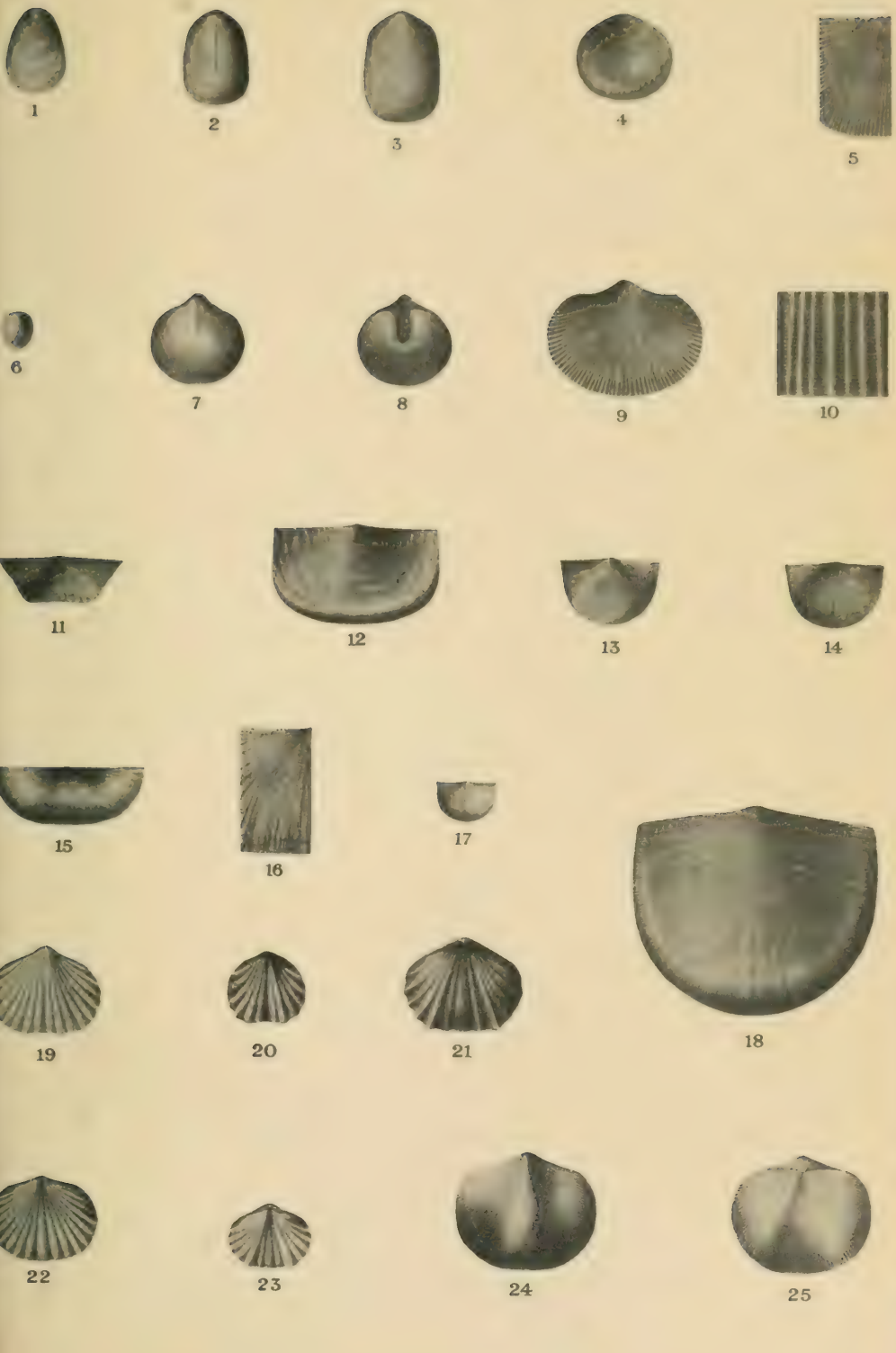
Explanation of Plate VII.

Pag

Fig. 1. *Lingula westonensis*, nat. size.
Fig. 2. *Lingula* cf. *progne*, nat. size
Fig. 3. *Lingula rectilateralis*, nat. size
Fig. 4. *Schizocrania filosa*, nat. size.
Fig. 5. " " Portion of surface, × 2
Fig. 6. *Pholidops cincinnatiensis*, nat. size.
Fig. 7. *Trematis millepunctata*. Brachial valve without ornamentation, nat. size.
Fig. 8. " " Pedicle valve, nat. size
Fig. 9. *Dalmanella rugostriata*. Pedicle valve, nat. size.
Fig. 10. " " Portion of surface, × 4.
Fig. 11. *Plectambonites* cf. *rugosus*. Pedicle valve, nat. size.
Fig. 12. *Leptaena rhomboidalis*. Pedicle valve, nat. size
Fig. 13. *Rafinesquina mucronata torontonensis*. Pedicle valve, nat. size
Fig. 14. " " " Brachial valve, nat. size
Fig. 15. *Plectambonites sericeus*. Pedicle valve, nat. size
Fig. 16. " " Portion of surface, × 2
Fig. 17. *Rafinesquina mucronata torontonensis*. Pedicle valve of young specimen, nat. size
Fig. 18. *Rafinesquina alternata*. Pedicle valve, nat. size.
Fig. 19. *Zygospira modesta*. Pedicle valve, × 2
Fig. 20. *Zygospira cincinnatiensis*. Pedicle valve, × 2
Fig. 21. " " Brachial valve of large example, × 2
Fig. 22. *Zygospira modesta*. Brachial valve × 2
Fig. 23. *Zygospira cincinnatiensis*. Brachial valve, × 2
Fig. 24. *Zygospira erratica*. Pedicle valve, nat. size.
Fig. 25. " " Brachial valve, nat. size.

Plate VII



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PROVINCE OF ONTARIO

DEPARTMENT OF MINES

Hon. H Mills, Minister of Mines

Willet G Miller, Provincial Geologist

NOTES

The Black River area is in the district of Timiskaming contiguous on the west to the Ben Nevis area and on the north to the Kirkland Lake gold area. The Black river area saddles the divide between the Hudson Bay slope and the drainage basin of the St. Lawrence river. The greater portion lies to the north of this height of land. The area has an average elevation of about 1,000 feet above the sea-level. Hills and ridges here and there throughout the area rise to elevations seldom in excess of 350 feet above the surrounding country.

Geology

Keewatin. The dominant rocks of the area are basic lavas of the Keewatin series consisting of basalts and andesites. In the Keewatin there is a widespread occurrence of diabase fairly fresh looking, but readily distinguishable from the Nipissing diabase by its more altered character. From the free distribution of pillow lavas, amygdaloidal basalts and other rocks possessing the structural characteristics of lava flows, the Keewatin formation in the entire area is thought to represent a succession of lava flows.

Iron formation was noted in only a few localities and then in quite minor quantities.

The Keewatin rocks are mostly massive, being rarely altered to schists. Schistose areas have been noted on the map.

Timiskaming Series. East of Nettie lake in Morrissette township is a small area of clastic rocks and their schistose derivatives which, from their similarity to certain rocks of adjacent areas, have been classified as Timiskaming. The upper horizon of these sediments is a hard conglomerate comprised of ellipsoidal water-worn pebbles of greenstone, banded chert, an occasional granite, and fragments of a bright red jasper, all of which readily separate from the matrix. Along the eastern shore of Nettie lake lower horizons consisting of schistose clastic rocks outcrop. The strike of the schistosity is north 40° east magnetic.

The Nettie lake clastic rocks comprise the only occurrence of the Timiskaming series in the area.

Pre-Algoman Intrusives. In many localities rocks of the Keewatin series have been intruded by dikes and boss-like masses of diabase and lamprophyre. The relationship of these to the Timiskaming series in the area is unknown, but these rocks are thought to be the correlatives of the Haileyburian intrusives in other areas in northern Ontario.

An interesting outcrop of fragmental rock may be seen just east of Nettie lake. The outcrop consists of a hill of pseudo-conglomerate 80 feet in height. The matrix is a basaltic rock having a prevailing green colour. The pebble and boulder contents consist not only of greenstone and amygdaloidal grey lava, but also of pink weathering granite, syenite, porphyries and, occasionally, red jasper.

Similar peculiar occurrences have been observed near Kirkland lake, on lot 4 in the fifth concession of Maisonville township and at Cobalt.

Algoman. The granite, syenite, grano-diorite (monzonite) intrusions, and the feldspar-porphyry and quartz-porphyry dikes occurring throughout the area are thought to belong to the Algoman series. The eastern extension of the Winnie lake-Maisonville batholith of hornblende-granite occupies the southwest quarter of Bernhardt township. This batholith varies quite locally from a hornblende-granite to a pink syenite, or to a quartz-diorite. These two latter seem to be the border facies of the granite, as this occurrence was particularly noted near the border of the batholith.

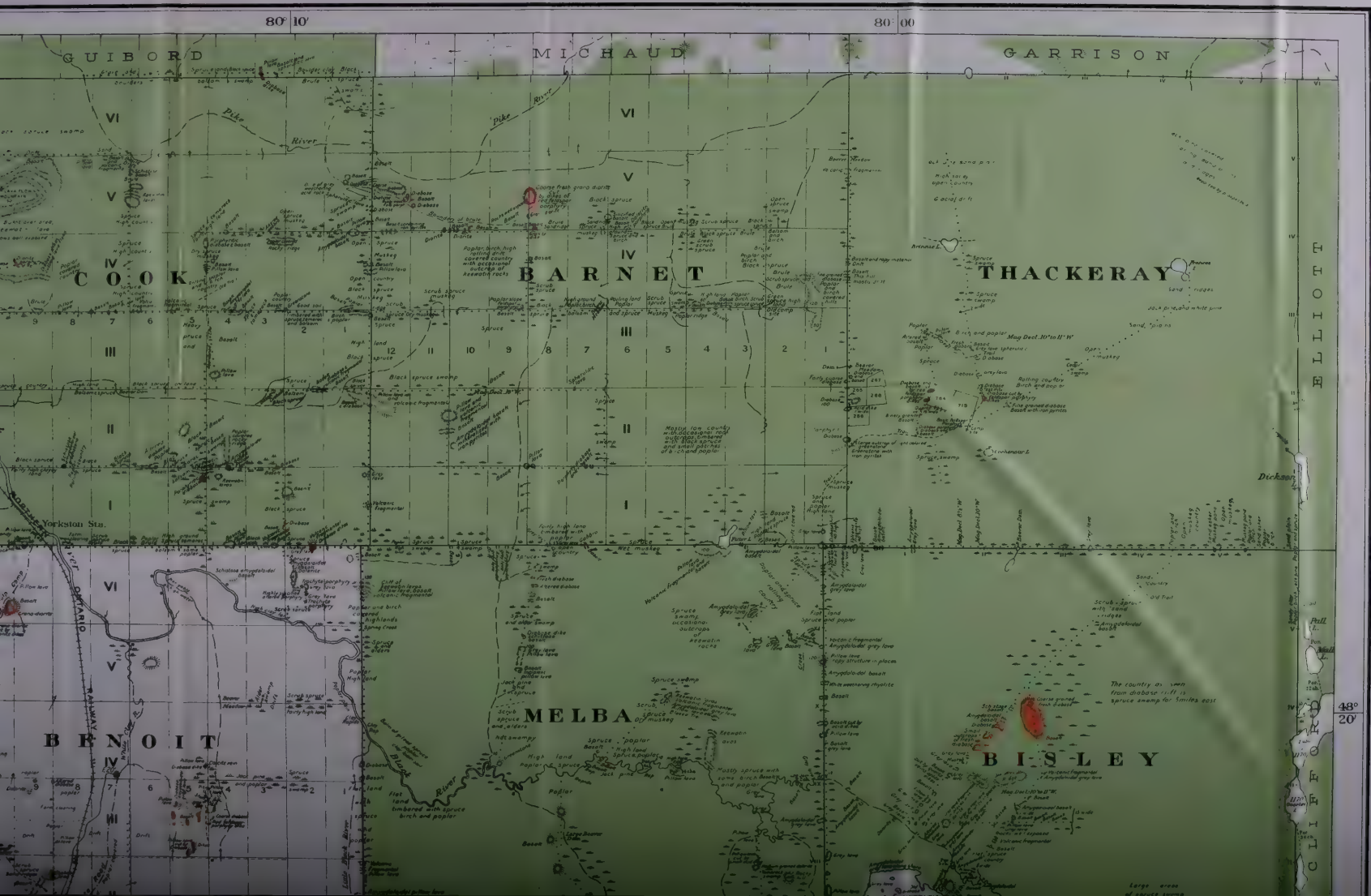
The granite passes gradually into a syenite or grano-diorite without material change in texture, and this is indicative of some process of differentiation subsequent to the entry of a single body of the present magma into its chamber rather than successive intrusions of different magma.

The dikes of feldspar-porphyry vary from a few feet to 100 feet in width, and many of these occurrences have either been necessarily omitted from or exaggerated on the

PROVINCE of ONTARIO

DEPARTMENT OF MINES

Hon. H. Mills, Minister of Mines — Willet G. Miller, Provincial Geologist



LEGEND

Glacial and Recent

Boulder clay, stratified clay, sand, gravel, peat.

UNCONFORMITY

PRE-CAMBRIAN

Keweenawan?

Diabase and gabbro.

INTRUSIVE CONTACT

Cobalt series

Conglomerate, arkose, greywacke, slate-like greywacke.

UNCONFORMITY

Algoman

Granite, syenite, grano-diorite, red and grey feldspar-porphyry, quartz-porphyry.

INTRUSIVE CONTACT

Pre-Algoman ??

Diabase and lamprophyre dykes and boss-like masses which intrude the Keewatin and are pre-Algoman; the relationship to the Timiskaming series is unknown.

INTRUSIVE CONTACT

Timiskaming series?

Conglomerate, quartzite, greywacke and schistose derivatives, some of which may be Keewatin.

UNCONFORMITY

Keewatin

A series of basic to acid lavas, i.e. basalt, diabase, andesite, grey lava, pillow lava, amygdaloid. Volcanic fragmental rocks and tuffs occur.

Symbols

Geological boundaries.

1607 / 1150' *Altitude in feet above sea level.*

100 *Altitude in feet above general level.*

Hill or Mountain.

Swamp.

magma.

The dikes of feldspar-porphyry vary from a few feet to 100 feet in width, and many of these occurrences have either been necessarily omitted from or exaggerated on the accompanying map.

Cobalt Series. The Cobalt series represents the latest clastic sediments of the area overlying the older rocks. This series consists of conglomerate, greywacké, argillite, arkose and quartzite. In a general way there is an orderly succession from a basal conglomerate through slate-like greywacké and argillite to greywacké, or more rarely to an impure quartzite, or an arkose which is in turn overlain by an upper conglomerate. The bedding planes in nearly all the outcrops seen were horizontal or nearly so. There was little or no fissuring of these rocks and the beds appeared undisturbed.

Keweenawan (?) Nipissing Diabase. The youngest rocks of the pre-Cambrian in the Black river area are dikes and small intrusive masses of diabase, trap, and gabbro, which intrude all the above-mentioned rocks. The rocks vary in texture from aphanitic to coarse gabbro-like. A microscopic examination of them shows that they are augite diabases irrespective of texture. The colour and texture are variable according to conditions of solidification. Small dikes and marginal masses are black, elsewhere the general colour is greyish-green to dark green and the texture medium. The percentage composition (megascopically) of the ferric minerals varies somewhat, and from the one outcrop, specimens differing greatly in appearance may be obtained. In some only a very minor amount of pyroxene is present. There are two types of diabase, one with olivine and the other olivine free, the latter being by far the more common type.

Economic Geology

The rock formations of the Black river area are akin to those of neighbouring areas already proven to be of great economic importance, i.e. Porcupine and Kirkland lake gold mining camps. The older formations have been freely intruded by Algoman granite, syenite and porphyries with which the deposition of the precious metal, gold, is said to be associated.

The vicinity of these acid intrusions and areas of schistose rocks noted on the accompanying map are promising localities which should be prospected for gold.

The borders of acid (granitic) intrusions should be carefully prospected for tin (cassiterite). Cassiterite may occur in small stringers and veins bordering granite knobs, in the granite itself, or as grains disseminated through the rock. Quartz, topaz, tourmaline and fluorite are associated minerals, as are also wolframite, scheelite and other contact minerals.

The pyrrhotite deposits should be tested for nickel and platinum.

Veins of calcite, usually under 12 inches in width, carrying some sphalerite and galena, were frequently seen in the area. The deposits of this nature which were observed were not considered to be workable for their value in zinc and lead; but it was noted that these deposits frequently carried values in gold and silver, particularly the latter, which, in one instance, ran as high as 57 oz. of silver per ton.

All serpentine, i.e. metamorphic rocks composed chiefly or wholly of the mineral serpentine, should be prospected, as possible sources of nickel, platinum, chromium and asbestos. Serpentine areas usually show local attraction, due to the presence of iron ores, pyrrhotite, or other magnetic minerals.

Scale, 50 Miles to 1 Inch.

Map № 30 c.

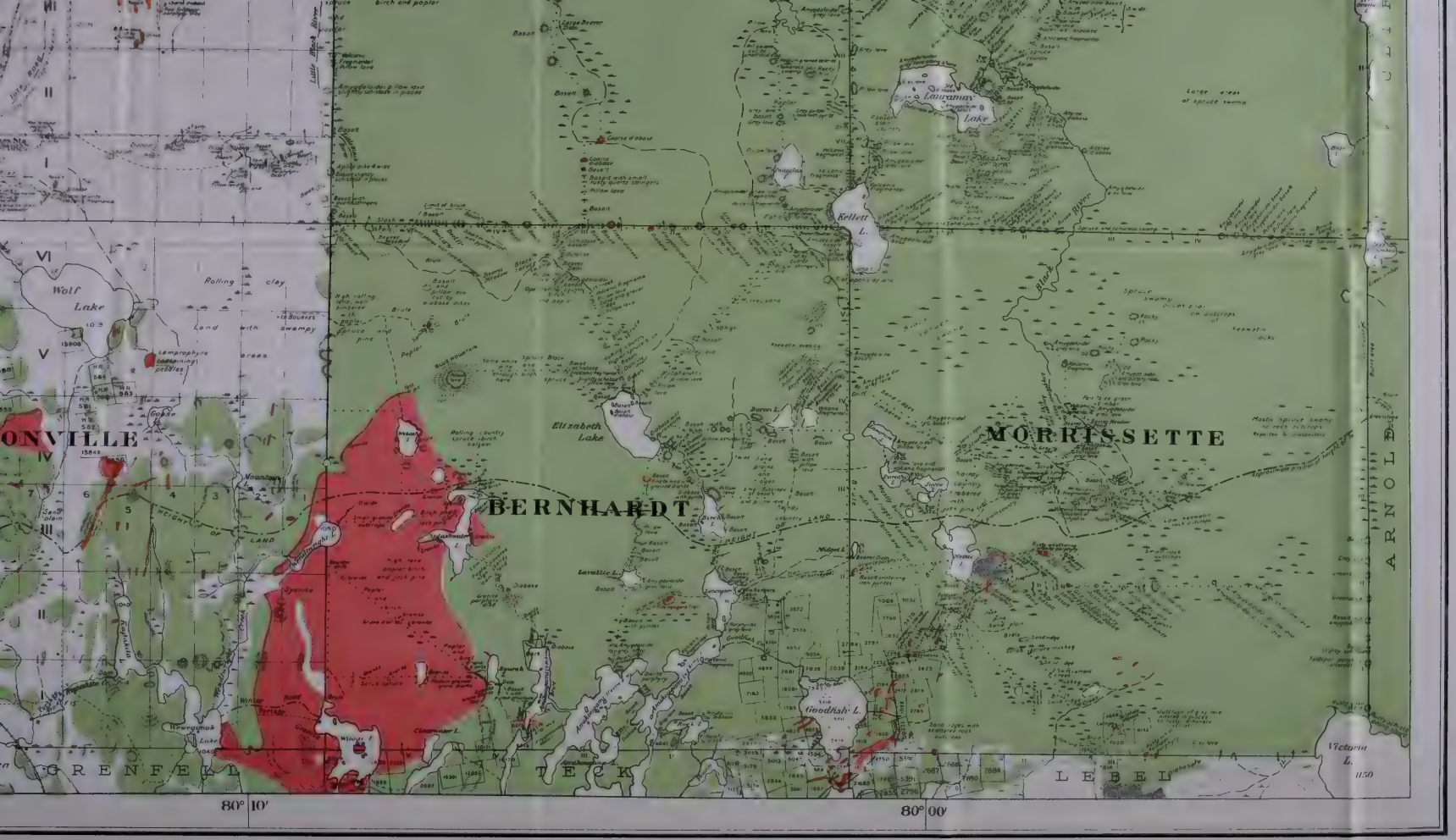
BLACK RIVER A

DISTRICT OF TIMISKAMING

To accompany Report by D.G.H. Wright in Volume 30, Ontario Department of Mines Re

Scale: 63360 or 1 Mile = 1 Inch

Chains 80 40 0 1 2 3



100 Altitude in feet above general level

Hill or Mountain.

Swamp.

Road.

Trail or Portage.

Cabin or Building.

The heavy dotted lines indicate the location of the exploration traverses made during the examination of the rocks. They were run by compass and the distance measured by pacing. The position of these traverses is shown so that prospectors and others will know exactly what parts of the area have been examined.

*Aneroid determinations (approximate).

Sources of Information

Geology, with the exception of Maisonville and part of Benoit townships, by D. G. H. Wright, 1920.

Topography, from plans of surveys from the Department of Lands & Forests, Ontario, also compass and micrometer surveys by D. G. H. Wright and assistants.

Map No. 23a–Kirkland Lake and Swastika Gold Areas, by A. G. Burrows and P. E. Hopkins, 1914.

Map No. 23b–Maisonville, Grenfell & Eby, by A. G. Burrows and P. E. Hopkins, 1914.

Map No. 25f Goodfish Gold Area, by A. G. Burrows and P. E. Hopkins, 1916.

Map No. 28b–Abitibi-Night Hawk Area, by C. W. Knight, A. G. Burrows, P. E. Hopkins and A. L. Parsons, 1919.

Map No. 29e–Ben Nevis Gold Area, by C. W. Knight, 1920.

** Only a few occurrences have been noted and some did those mapped as Nipissing may be pre-Algoman.

Map No 30 c.

BLACK RIVER AREA

DISTRICT OF TIMISKAMING

To accompany Report by D.G.H Wright in Volume 30, Ontario Department of Mines Report, 1921

Scale: 63360 or 1 Mile = 1 Inch

Chains 80 40 0 1 2 3 4 Miles

PROVINCE OF ONTARIO
DEPARTMENT OF MINES

Hon. H Mills Minister of Mines. Willet G Miller Provincial Geologist

Map No. 30b.

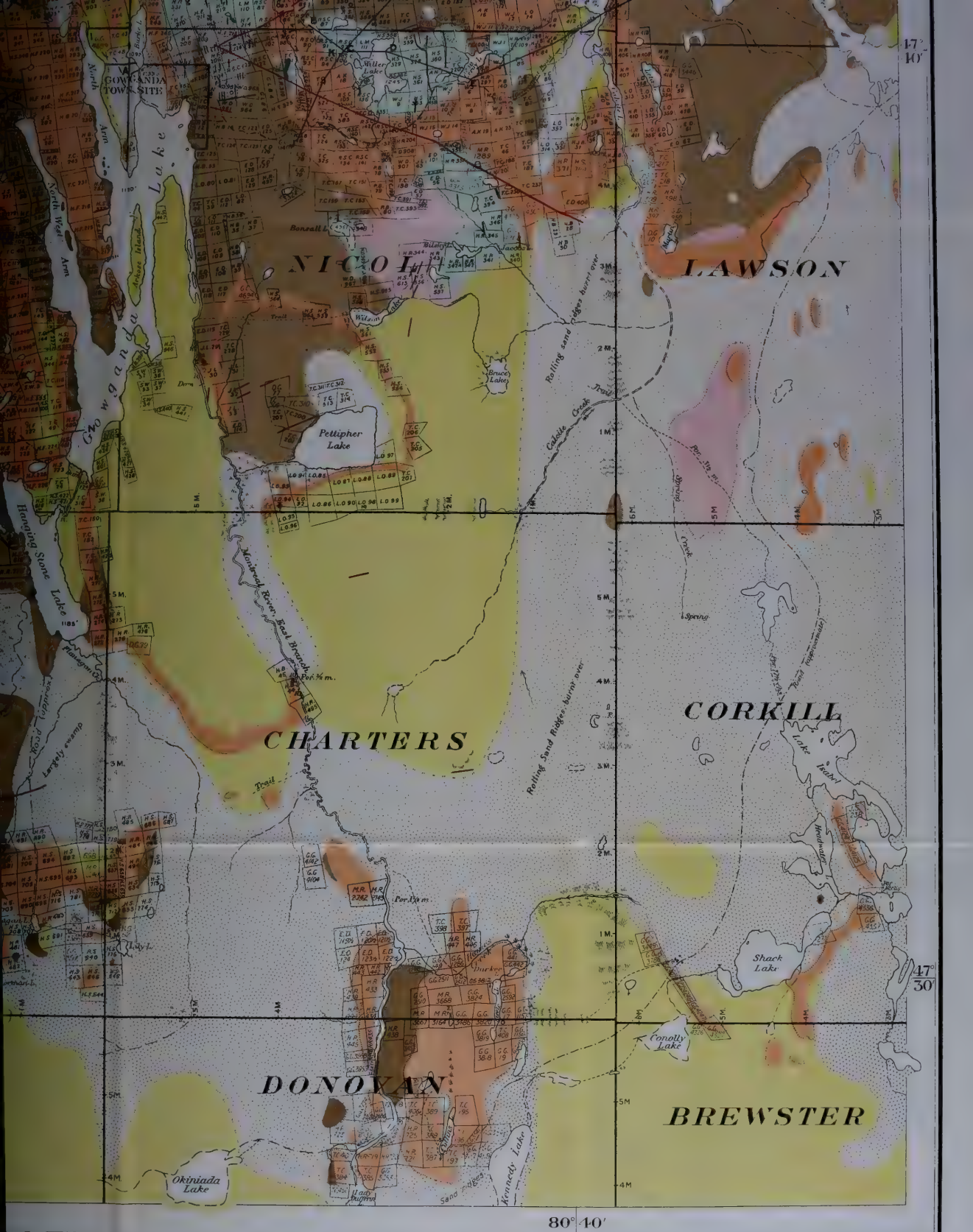
PART OF THE
GOWGANDA SILVER AREA
DISTRICT OF TIMISKAMING

To accompany Report of A.G.Burrows in Volume 30, Ontario Department of Mines Report, 1921.

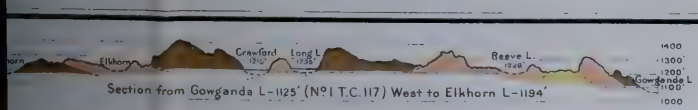
Scale. ~~63,360~~ or 1 Mile = 1 Inch

80 40 0 1 2 3 4 Miles

First Edition, 1910.
Second Edition, 1921.



See Insert in Report for Sections G.-H., J.-K.-L., and M.-N.



Section from Gowganda L-1125' (No 1 T.C. 117) West to Elkhorn L-1194'

Section on line A B C D E F

Scale Horizontal ½ Mile - 1 Inch Vertical 800 ft. 1 Inch

Hon. H. Mills, Minister of M...

PAR...

GOWGANDA...

DISTRICT...

To accompany Report of A.G. Burrow...

Scale

Chains 80 40 0

LEGEND

Glacial and Recent

Sand and Gravel.

PRE-CAMBRIAN

Post-Keweenawan

Olivine diabase, quartz diabase.

INTRUSIVE CONTACT

Keweenawan (Nipissing)

Quartz diabase.

INTRUSIVE CONTACT

Animikean (Cobalt series)

Arkose, quartzite, and conglomerate.

Conglomerate, greywacke, quartzite.

UNCONFORMITY

Laurentian ?

Granite, syenite, gneiss.

INTRUSIVE CONTACT

Keewatin

Quartz-porphyry.

Complex of highly altered volcanic rocks, basalt, andesite, &c., tuffs, iron formation.

Diabase dikes older than Animikean.

Serpentine younger than Keewatin.

Symbols

Road.

Trail.

Transmission line.

P. or Por. *Portage.*

F. *Fall.*

R. *Rapid.*

Hill.

Swamp.

1125' *Elevation above sea level.*

Shafts.

Glacial Striae.

Magnetic declination N. (8°-9°) W.

SOURCES OF INFORMATION

Geological Map Gowganda Silver Area, Vol. XIX, Part II, Ontario Department of Mines, 1913.

Plans of Surveys from Surveys Branch, Department of Lands and Forests, Ont.

Geological Survey of Canada, Gowganda Mining Division 1909, W. H. Collins.

Special Surveys of Lakes, Roads, Elevations, Etc., by W. R. Rogers.

Additions by A. G. Burrows, 1920.
Compilation of map by P. A. Jackson and H. C Smith.

Mining Claims

HAULTAIN AND NICOL.

R.S.C. 90, 91, 93, 94, 95—Miller Lake-O'Brien.
R.S.C. 83 to 89—Bonsall.

80° 50'

47° 40'

RANKIN

VAN HISE

KNIGHT

TYRRELL

MILNER

Kawakanika Lake

Lake Haultain

Montreal River, West Branch

Montreal River

Foot Lake

Beaver L.

Pantaloon L.

Otter L.

Gould L.

Brett L.

McIntosh L.

McLoughlin

Serpentine Lake

Spawning Lake

Obushkong Lake

Burke L.

Stuart L.

Cyrille L.

Gorman L.

Logan L.

Milne L.

Boyd

Manzuratti Lake

Elkhorn Lake

Wabuoos Creek

Sand plain

Bisco Road

GOWGANDA TOWN SITE

North Arm

North West Arm

Lake Gowganda

Arkose Island

Heaping Bay

1129'

1120

1104'

P. or Por. Portage.

F. Fall.

R. Rapid.

Hill.

Swamp.

1125' Elevation above sea level.

Shafts.

Glacial Striae.

Magnetic declination N. (8°-9°) W.

SOURCES OF INFORMATION

Geological Map Gowganda Silver Area, Vol. XIX, Part II, Ontario Department of Mines, 1913.

Plans of Surveys from Surveys Branch, Department of Lands and Forests, Ont.

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Additions by A. G. Burrows, 1920.
Compilation of map by P. A. Jackson and H. C Smith.

Mining Claims

HAULTAIN AND NICOL.

R.S.C. 90, 91, 93, 94, 95—Miller Lake-O'Brien.
R.S.C. 83 to 89—Bonsall.
H.S. 351—Symmes-Young.

HAULTAIN

R.S.C. 101, etc.—Castle.
R.S.C. 102—Everett.
S.W. 8—Barbara.
H. S. 350—Miller Lake Syndicate.

NICOL

R.S.C. 106, etc.—Castle.
R.S.C. 98—Walsh.
R.S.C. 135-6—Hart.
T.C. 315—Northern.
H.R. 204—Canadian Gowganda.
T.C. 220—Collins.
W.J. 1—Silver Bullion.
W.J. 17—La Fayette.
H.R. 715—Chapelle.
W.D. 961, etc.—Big Four.
W.J. 8, etc.—Leroy.

MOREL.

L.O. 305, etc.—Bishop.
E.D. 4, etc.—Donaldson.
W.D. 12A, etc.—Boland.

MILNER

H.R. 249-252—Mann.
S.W. 3-5—Reeve-Dobie.
H.F. 221-4—Crews-McFarlan.
H.F 225—O'Brien.
P.B. 154-5—Welsh.
H.S. 723-4—South Bay.
H.S. 343—Labrick.
T.C. 118—Milne.
H.S. 339—Crawford.
T.C. 136, etc.—Bishop.
H.R. 292, etc.—Gowganda Lake.
J.S. 282—Northcliff.
H.S. 335—Silvers.
H.S. 371—Boyd-Gordon.

LAWSON

H. R. 408—Sanderson
L.O. 357—Caleta.
L.O. 313—Bishop.
H.R. 397, etc.—Powerful.

VAN HISE

H.R. 458—Alpine.
T.C. 141—Hedlund.

DONOVAN

H.R. 720—Duggan.
G.G. 3542—Wilder.

CHARTERS

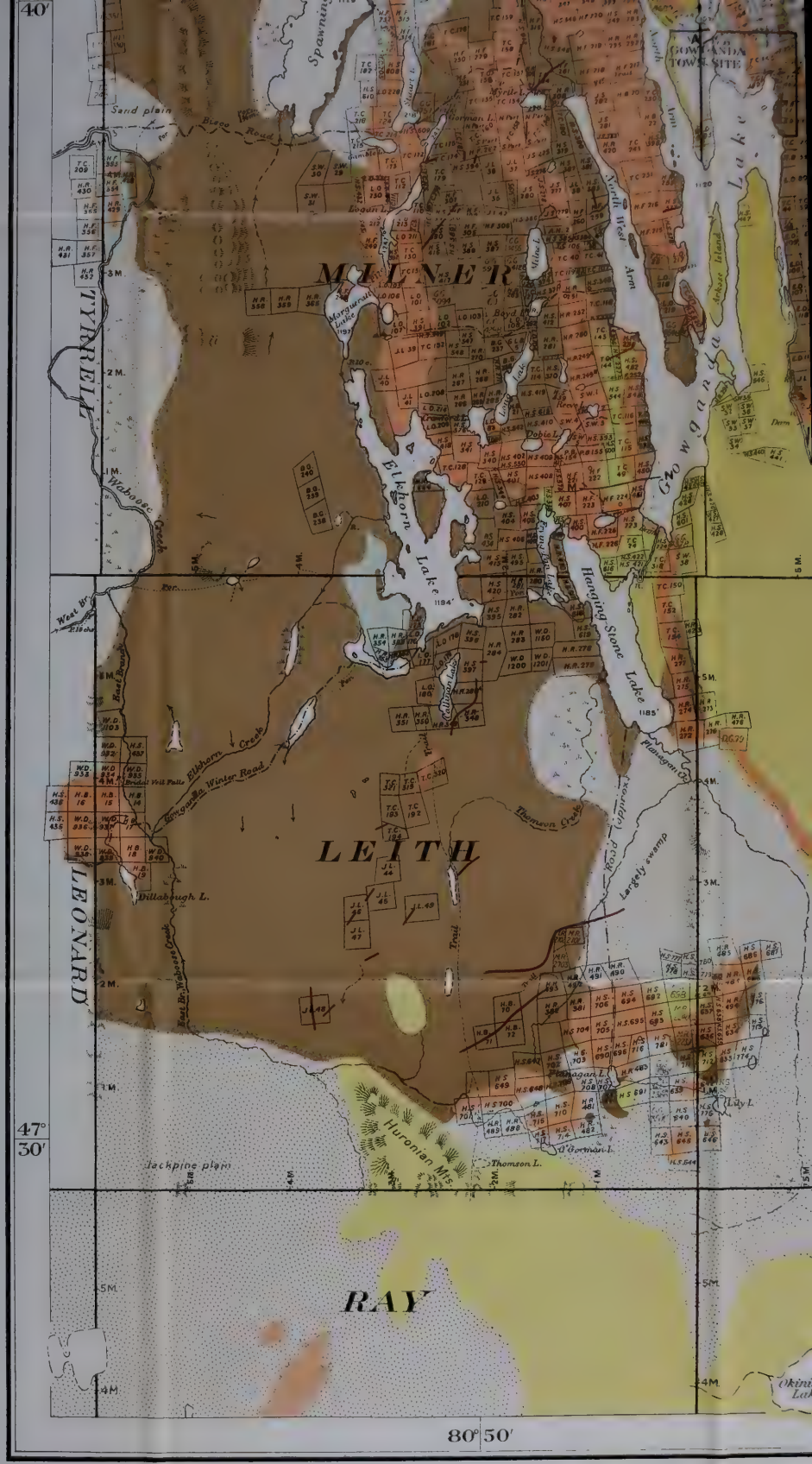
E.D. 123½—Garvey.
H.R. 439-Haines.
G.G. 17, etc.—Willans.

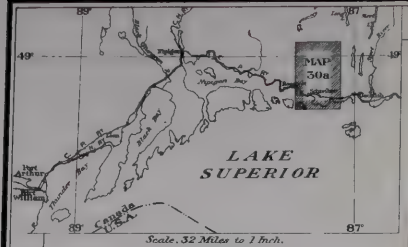
CORKILL

G.G. 3786—Kell

LEITH

H.S. 716, etc.—Hudson Bay
H.S. 693, etc.—Silverado





Economic Notes

The principal mineral sought for in the area is gold. There was a production at the Empress mine near Jackfish between 1896 and 1899. Small shipments of gold ore for test purposes have been made from the Otisse and Jackson properties east of Schreiber and from the McQuaig and Sjolander-McKirdy claims at Big Duck lake. The McKellar-Longworth prospect, south of Schreiber, was working in 1920.

Iron pyrites is found in encouraging quantities on the Morley, south of Schreiber, and on the Mudge, near Cook lake, but no shipments have been made apart from a carload in 1897 from the Morley.

Zinc occurs as zinc blende in diorite at the Zenith zinc mine, 11 miles north of Selim station. Between 1899 and 1901 approximately 2,700 tons were shipped.

Copper, occurring as chalcopyrite in quartz, can be seen in appreciable quantities at Big Duck lake; native copper occurs in veinlets and amygdules in Keweenawan lava on the northwest shore of Copper island.

Large bodies of pyrrhotite occur in various parts of the area; but samples taken for examination showed the absence of nickel, platinum, gold or silver.

For the last ten years cobbles and pebbles have been selected from a gravel pit near Jackfish station and shipped to cement plants for use in grinding mills.

87° 20'

87° 10'

49° 00'

PROVINCE OF ONTARIO
DEPARTMENT OF MINES

Hon. H. Mills, *Minister.*

Willet G. Miller, *Provincial Geologist.*

LEGEND

PLEISTOCENE

Glacial and Recent

- *Sand and gravel*

PRE-CAMBRIAN

Keweenawan

- *Normal diabase, quartz diabase, olivine diabase dykes and sills.*
- *Basic amygdaloidal lava flows.*
- *Conglomerate, tuff, red dolomite, and limestone.*

Animikie

- *Black shale, iron formation, and conglomerate*

Algoman (?)

- *Quartz, feldspar and granite porphyry, schistose in places.**
- *Hornblende and biotite granite and syenite, gneissic in places.***

Pre-Algoman (?)

- *Serpentine. (Outcrop on Bear lake.)*

Keewatin

- *Felsite, rhyolite with subordinate basalt areas.*
- *Iron formation.*
- *Pillow lava altered to hornblende, chlorite, carbonate and sericite schist, rhyolite, agglomerate, tuff, diorite, hornblendite and felsite.*
- *Grey garnet mica schist: (Coschiching ?).*

*The badly sheared porphyries may be of older age than the Algoman.

**The granite gneisses near Birch and Rope lakes may be Laurentian.

Symbols

- *Shaft or Prospect Pit.*
- *Vein.*
- *Strike and Dip.*
- *Strike and Vertical Dip.*
- *Glacial Striæ.*
- *Road and Building.*
- *Trail or Portage.*
- *Railway with Station and Mileages west of divisional points, White River and Schreiber.*
- *Swamp.*
- *Hill.*
- *Altitude in Feet above Sea Level.*
- *Geological Boundary, defined.*
- *Geological Boundary, assumed.*

Gold Claims

T.B. 1686—Beaver or McQuaig.
T.B. 1801, 1955—Sjolander-McKirdy.
B.J. 122 McKellar-Longworth.
T.B. 3354, 3326—Jackson.
T.B. 3412 (A.L. 217)—Otisse.

Pyrite Claims

R. 600—Morley.
T.B. 1048—Mudge.

Zinc Claims

30 T—Zenith.
K.S. 70—Gesic.

NOTE—*All claim numbers having four digits are T B (Thunder Bay) claims, the letters "T. B." having been omitted on the map.*

Map No. 30a.

SCHREIBER-DUCK LAKE AREA

DISTRICT OF THUNDER BAY

To accompany report by P. E. Hopkins, in Volume 30, Ontario Department of Mines Report, 1921

Scale: $\frac{1}{63,360}$ or 1 Mile 1 inch

Chains 80 40 0 1 2 3 4 Miles

Sources of Information

Plans from Surveys Branch, Department of Lands and Forests, Ontario.

Lakes shown in solid lines were surveyed by micrometer and prismatic compass.

Magnetic and astronomic north are approximately identical.

Topography and geology of area from Lynx to Birch Lake, Copper Island and Rope Lake by T. L. Tanton, Geological Survey of Canada.

Chart from Department of Naval Service of Canada.

Geology by P. E. Hopkins.

Drawn by P. A. Jackson and H. C. Smith.

PROVINCE OF ONTARIO

DEPARTMENT OF MINES

Hon. H. Mills, Minister of Mines.

Willet G. Miller, Provinci

BOSTON

McELRO

To Cochrane 93 miles

80° 00'

79° 50'

To Larder Lake

Dane Sta.

Dane to Larder Lake (7 miles)

Moose Creek

Jack pine ridge

Rolling

Sand ridge

Sand hill

Diabase

High drift

Greenstone and felsite mixed

Breccia

Felsite

Basalt

Spherulitic greenstone

Pillow lava

Gravel

Clay

Marsh

Rapids

Tom

Hughes McElroy

Charest

Gold Leaf

Ivanhoe

Arthier

O'Donald

Patricia

Allied Mines

Miller Independence

Campbell

Cotter

Connell McDonough

Kennedy Boston

Irish

Boston Creek

Boston Creek Road

Smith Lake

ROUND LAKE

BLANCHE RIVER

North Branch

Spring

T.C. 63 Farm

Ballast Pit

895'

941'

48° 00'

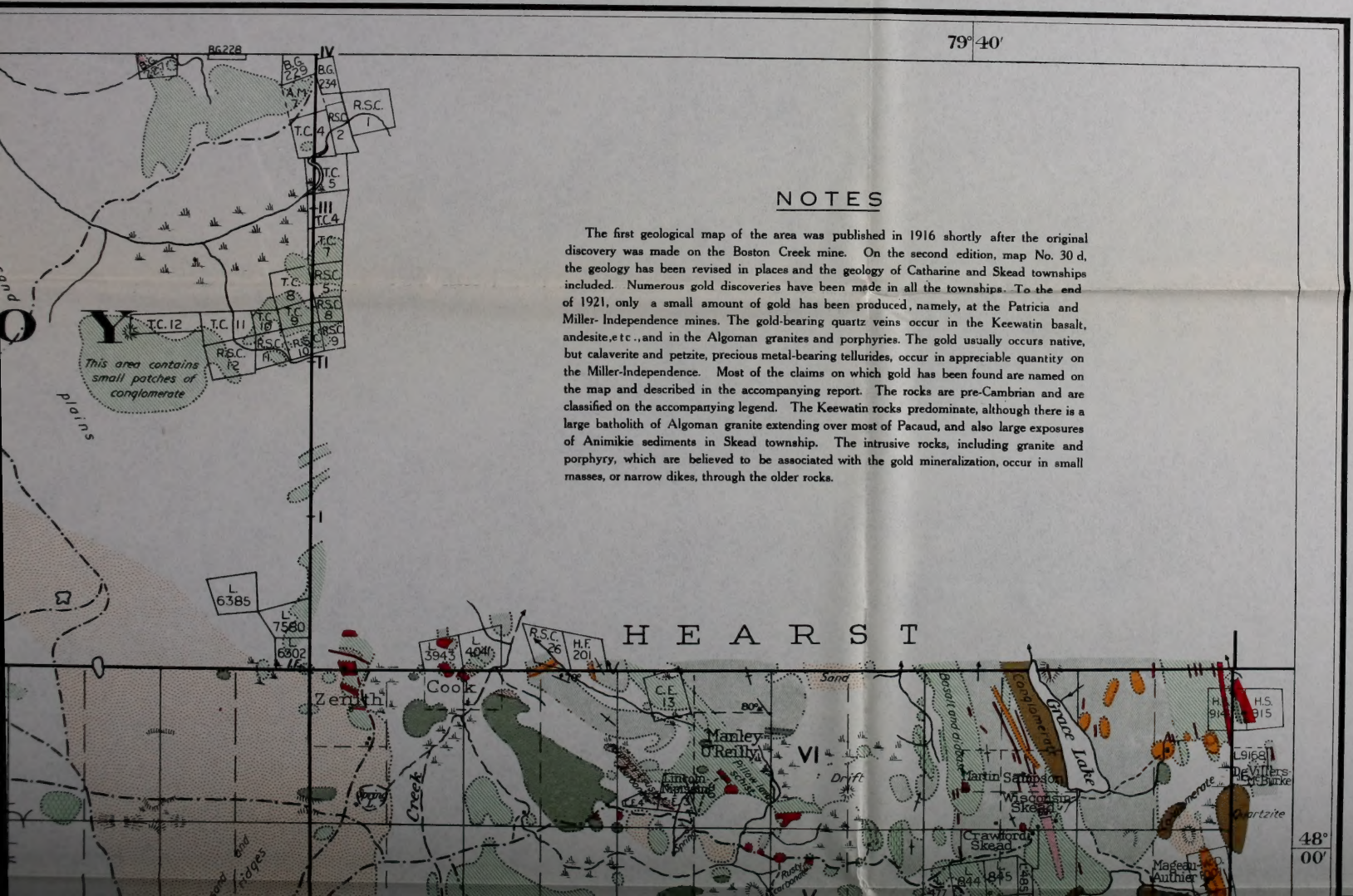
II

III

IV

VI

Miller, Provincial Geologist.



NOTES

The first geological map of the area was published in 1916 shortly after the original discovery was made on the Boston Creek mine. On the second edition, map No. 30 d, the geology has been revised in places and the geology of Catharine and Skead townships included. Numerous gold discoveries have been made in all the townships. To the end of 1921, only a small amount of gold has been produced, namely, at the Patricia and Miller- Independence mines. The gold-bearing quartz veins occur in the Keewatin basalt, andesite, etc., and in the Algoman granites and porphyries. The gold usually occurs native, but calaverite and petzite, precious metal-bearing tellurides, occur in appreciable quantity on the Miller-Independence. Most of the claims on which gold has been found are named on the map and described in the accompanying report. The rocks are pre-Cambrian and are classified on the accompanying legend. The Keewatin rocks predominate, although there is a large batholith of Algoman granite extending over most of Pacaud, and also large exposures of Animikie sediments in Skead township. The intrusive rocks, including granite and porphyry, which are believed to be associated with the gold mineralization, occur in small masses, or narrow dikes, through the older rocks.

LEGEND

PLEISTOCENE

Glacial and Recent

- *Sand and Gravel*
- *Boulder clay, stratified clay, swamp and sand.*

PRE-CAMBRIAN

Keweenawan

- *Quartz diabase, olivine diabase.*

Intrusive Contact

Animikie (Cobalt Series)

- *Conglomerate, quartzite and greywacké.*

Unconformity

Algoman

- *Feldspar-porphyry, quartz-porphyry, lamprophyre.*
- *Biotite and hornblende granite, syenitic in places.*

Intrusive Contact

Haileyburian (?)

- *Serpentine.*

Intrusive Contact

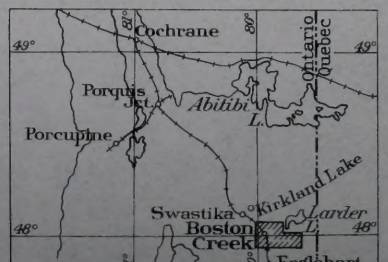
Timiskamian (?)

- *Schistose conglomerate, greywacké and slate.*

Unconformity

Keewatin

- *Rusty weathering carbonate.*
- *I.F. Iron formation*
- *Dacite or diorite porphyry*



Scale, 50 Miles to 1 Inch.

MAP Nº 30 d.

BOSTON-SKEAD GOLD

DISTRICT OF TIMISKAMING, ONTARIO

To accompany Report by A.G. Burrows *and* P.E. Hopkins *in Volume 30, Part 6, Ontario Department*

Scale : $\frac{1}{41,520}$ or ¾ Mile = 1 Inch

Chains 80 60 40 20 0 1 2 Miles

Metres 1000 500 0 1 2 3 Kilometres

Andesite

Volcanic fragmental

Ellipsoidal, amygdaloidal and spherulitic lavas, altered in places to hornblende and chlorite schist, diabase, tuff, iron formation and andesite.

Signs

- Hill.
- Swamp.
- Creek.
- Trail or Portage.
- Road and Building.
- Electric Transmission Line.
- 941' — Elevation in feet above sea-level.
- Railway with Station and Mileage north of North Bay.
- Glacial Striae.
- 80° — Strike and Dip.
- Shaft or Prospect Pit.
- Geological Boundary, defined.
- Geological Boundary, assumed.
- Vein.

First Edition, 1916.
Second Edition, 1921.

LD AREA

TARIO.

partment of Mines Report, 1921

2 Miles
ilometres

Sources of Information.

Plans from Surveys Branch, Department of Lands and Forests, Ontario.

Map No. 25 d — Boston Creek Gold Area accompanying Volume XXV, Part I, Ontario Bureau of Mines, Report, 1916.

Elevations based on Temiskaming and Northern Ontario Railway surveys.

Geology by A. G. Burrows and P. E. Hopkins.

Drawn for Photo-lithography by P. A. Jackson and H. C. Smith.